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ESKOM GENERATION GROUP

ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED BRAAMHOEK PUMPED STORAGE SCHEME

VOLUME I OF IV: ENVIRONMENTAL IMPACT REPORT

ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED BRAAMHOEK PUMPED STORAGE SCHEME

T I T L E P A G E

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EXECUTIVE SUMMARY

This Environmental Impact Report (EIR) is part of the process followed by ESKOM to raise the intensity of information on the Braamhoek Pumped Storage Scheme to feasibility level. Two similar other sites are also under investigation i.e. Steelpoort and Impendle. However, the specific requirements of a pumped storage scheme do not allow for alternatives to be considered at a specific site, nor is the three sites under investigation evaluated as alternatives, but rather as separate possible projects.

The regulations R1182 for the Identification of Activities which may have a Substantial Detrimental Effect on the Environment made under Section 21 of the Environmental Conservation Act, No 73 of 1989, were published after the commissioning of this study. However, the intention was to perform this Environmental Impact Assessment in compliance with the said Regulations.

The complexity of the potential environmental impacts to be assessed dictated the establishment of a multi disciplinary team. Team members were selected on grounds of their expertise and experience and obtained from the following companies and institutions:

- Poltech (Pty) Ltd;
- Urban-Econ (Pty) Ltd;
- Index (Pty) Ltd;
- CSIR Environmentek;
- National Cultural History Museum;
- Gouws Uys & White (Pty) Ltd; and
- University of Natal.

The proposed site for the Braamhoek Pumped Storage Scheme is situated 23 km northeast of Van Reenen on the farms Braamhoek and Bedford. The study area forms part of the uTukela Regional District and is situated on the boundary of Kwa-Zulu Natal and the Free State. The area falls within the

Drakensberg escarpment. The upper reservoir is on the head water tributary of the Wilge River, which flows into the Vaal River System. The lower reservoir is in the headwater of the Klip River, which in turn flows south-eastwards into the Tugela River. Maps indicating the location of the proposed scheme are included in Annexure C (Volume III).

A pumped storage scheme utilises surplus electricity generation capacity on the Eskom system during off-peak hours to pump water from the lower to the upper reservoir and release this water again during peak load hours to generate electricity. A pumped storage scheme thus relieves the need for other peaking plant such as gas fired turbines to meet peak loads and also relieves the need for the switching off of coal fired generation during periods of low power system load.

This practice increase the expected life of coal fired generation units, in addition to the reduction in nett pollutants and waste generated during periods of peak load demand.

The proposed scheme consists of two dams, interconnected by enclosed tunnel systems, with pump turbine units with a potential generation capacity of approximately 1000 MW.

Ten impacts with a High significance were identified during the Environmental Impact Assessment. Of the above ten impacts, eight are Adverse Impacts, and two are Beneficial Impacts. The eight Adverse Impacts with a high significance are the following:

- Effect of the proposed upper reservoir on the water supplied from the Bedford sub-catchment to the Wilge River;
- Loss of wetlands in the upper reservoir basin, and basin bellow;
- Effect on fish species, *Barbus*, that occur in upper reservoir area;
- Stabilised water flow from the reservoirs may cause a change in the agricultural production along the rivers; this may lead to environmental degradation.
- Impact of the building of the reservoirs on the farming units of Braamhoek and Bedford;
- Current road conditions would not support the construction and operation of the proposed scheme;
- Disposal of construction related waste; and
- Illumination of the construction site and operational site may cause light pollution.

All of the above impacts, with the exception of the loss of wetlands, could be adequately mitigated.

The construction of the upper reservoir will lead to a loss of a small percentage of the wetlands in the area of the upper reservoir. These wetlands are well represented throughout the upper region of the Drakensberg escarpment. Loss of the relatively small area of wetlands due to the construction of the proposed Bedford (upper) reservoir should therefore not lead to a loss in unique habitat or any endangered, threatened or rare species of fauna and flora.

In total 21 impacts with a Medium Significance were identified. Of these 13 are adverse – and eight are beneficial impacts. Of the 13 adverse impacts one impact can not be mitigated, namely:

- Effect on amphibian and invertebrate species due to construction of the upper reservoir.

No endangered species of amphibians and invertebrate were identified in the area of the proposed upper (Bedford) reservoir. Although a change in the specie diversity in the area will occur due to the construction of the upper reservoir, this will not lead to any loss of amphibian or invertebrate species.

From the findings and results of the Environmental Impact Assessment it is concluded that the development of the proposed Braamhoek Pumped Storage Scheme on the environment is beneficial.

Furthermore, that associated adverse impacts could be reduced to acceptable levels by the implementation of mitigation measures.

1.0. INTRODUCTION

1.1. BACKGROUND

A pumped storage scheme consists of two water reservoirs, the one elevated above the other, interconnected by a system of shafts and tunnels. Hydroelectric turbine generating units are situated in the tunnel system. The mentioned generating units can be used to pump water from the lower reservoir to the elevated reservoir.

Water released from the upper reservoir to the lower reservoir pass through the turbine generating units, thereby providing the kinetic energy to drive the units. In this manner electricity is generated that is used to supplement other generating units on the national grid, such as coal fired power stations, during periods of peak demand. The turbine generating units are used to pump the water back to the elevated reservoir in periods of low electricity demand on the national grid.

In this manner clean electricity is produced from a reusable source of kinetic energy. See drawing, Scoping Report Annexure C (Volume III) for a layout of the Braamhoek scheme.

The development of pumped storage schemes is limited by the minimum specifications for such schemes with regard to inter alia requirements related to water supply, appropriate reservoir basins with sufficient elevation and minimum horisontal distance, connection to the national electricity transmission grid, geology of base rock and environmental impacts.

Through careful consideration of the basic requirements for a pumped storage scheme Eskom has build a portfolio of viable prospective sites. These sites are situated in various provinces. Currently the information on the prospective sites is at the pre-feasibility level providing technical, financial and environmental indicators. According to the ten year planning horizon in Eskom, which is continually being revised as part of the Intergrated Electricity Plan, the first of the prospective pumped storage schemes will have to come into operation from approximately 2008 onwards. The next step is to raise the information intensity to the feasibility level for the most promising sites. **It is important to note that the different sites are not evaluated as**

alternatives, but rather as separate potential projects. As mentioned above, the specific requirements of a pumped storage scheme do not allow for alternatives to be considered at a specific site, however, limited adjustments can be accommodated. Therefore, the feasibility study has to indicate the feasibility to proceed with a specific scheme at the indicated site.

The purpose of this Environmental Impact Report is to reflect the findings of a comprehensive Environmental Impact Assessment performed at the prospective Braamhoek site. Furthermore, to indicate significant environmental impacts and the environmental mitigation that will be required, as well as any "fatal flaw impacts" that my exist and therefore prevent the site to be considered for development. The report also has to clearly indicate positive impacts that the proposed development may have, and how such impacts should be managed to ensure maximum advantage for the environment.

1.2. STUDY PLAN

ESKOM issued an invitation to submit a Proposal for an Environmental Impact Assessment for the prospective pumped storage schemes Braamhoek, Steelpoort and Mutale, on 30 July 1997. Discussions were held with various consultants during the week of 4 to 8 August 1997 and on 27 August 1997 POLTECH (PTY) LTD, and its associates, were requested to submit a detailed proposal to perform an Environmental Impact Assessment on feasibility level for the Braamhoek Pumped Storage Scheme.

The above proposal was submitted on 16 September 1997. Negotiations followed between POLTECH (PTY) LTD and ESKOM during October 1997, and during December 1997 an Agreement was signed. In terms of the above agreement POLTECH was to perform an Environmental Impact Assessment for the prospective Braamhoek Pumped Storage Scheme.

Although Regulation R1182 for the Identification of Activities which may have a Substantial Detrimental Effect on the Environment made under Section 21 of the Environmental Conservation Act, No 73 of 1989, were published only on 5 September 1998, the intention was to perform this

Environmental Impact Assessment in compliance with the said Regulations. However, the following aspects have to be considered:

- Untested nature of the said regulations and absence of clear guidelines on the application of the regulations for both the authorities and applicants alike; and
- The fact that the current study had to enhance the level of environmental information to a feasibility level, though no final design and concepts existed for the prospective scheme.

The above considerations presented opportunities to the authorities, applicant and consultants to identify significant environmental issues and to provide for adequate mitigation of these impacts in the final designs and procedures of the prospective scheme.

The plan of study followed during the Environmental Impact Assessment is diagrammatically presented in figure 1.

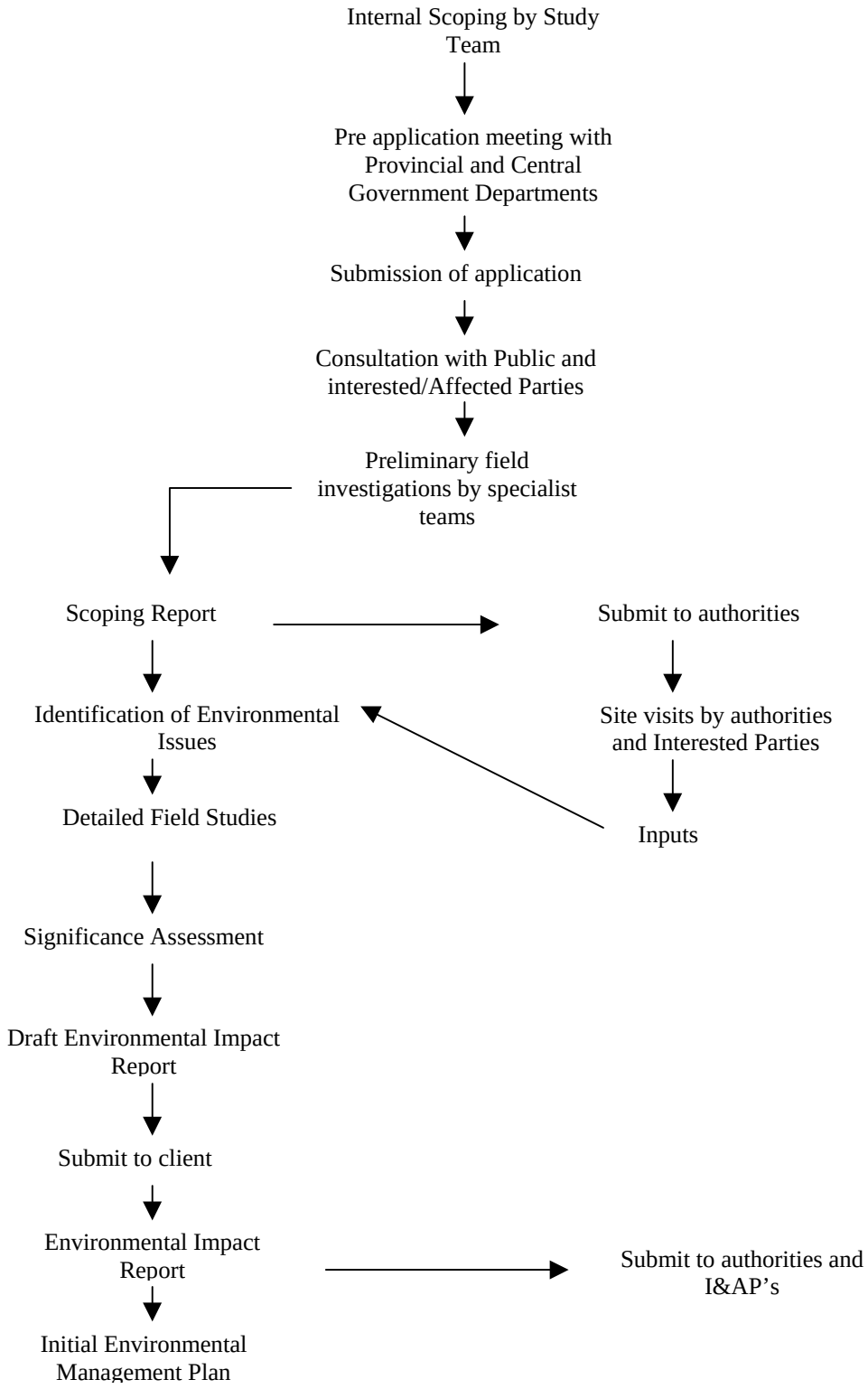

FIGURE 1: PLAN OF STUDY, BRAAMHOEK EIA

The above plan of study was compiled during the proposal stage of the study and took into consideration draft legislation and guideline documents which existed at that stage.

It is important to note that the plan of study proposed in September 1997 complies with the principals contained in the final regulations and official documentation printed subsequently to the date of the compilation of the study proposal.

This Environmental Impact Report therefore reflect the findings and conclusions of the Study Team that performed the Environmental Impact Assessment. The report that contains the following:

Volume I: Environmental Impact Report

- **Introduction**
- **Study Plan**
- **Study Team Composition;**
- **Alternatives;**
- **Brief Environmental Description;**
- **Project Description;**
- **Public Participation Process;**
- **Significance Description of Impacts; and**
- **Conclusion.**

Volume II: Annexure A: Specialist Study Reports

Volume III: Annexure B: Public Participation and Awareness
Annexure C: Scoping Report

Volume IV: Environmental Management Plan

1.3. STUDY TEAM

The complexity of the potential environmental impacts to be assessed in the physical, ecological, social and socio-economic spheres dictated the establishment of a multi disciplinary team of scientists. Team members were selected on the grounds of their expertise and experience. The study team consisted of the following members:

- **POLTECH (PTY) LTD**

Contact person(s) : Willem Lombaard, Pieter van der Merwe,

Responsible for :
EIA Study Co-ordination and Management
Terrestrial ecological characteristics
Nature and level of present and future pollution assessment
Risk and hazard assessment
Health and Safety assessment
Participation of National Bodies
Compilation and submission of Scoping Report and Environmental Impact Report, including the Environmental Management Plan and preparation of Environmental Specifications for tender purposes.
Compilation of the EMPR for quarries & borrow pits

- **URBAN-ECON Development economists:**

Contact person : Marica Cook

Responsible for : The socio-economic assessment and public participation

- **INDEX (Pty) Ltd**

Contact Person : Andries Gouws, Mark Mfekoe & Phillip Nel

Responsible for : Terrestrial Resources (soil, grazing), Land Use Potential, Agriculture, Public Participation, Social Assessment, Capacity Building.

- **ENVIRONMENTEK**

Contact Person : Alan Batchelor

Responsible for : Aquatic and wetland ecological assessment

- **NATIONAL CULTURAL HISTORY MUSEUM:**

Contact person : Johnny van Schalkwyk

Responsible for : Cultural resources assessment

- **GOUWS UYS & WHITE**

Contact person : Pieter de Lange

Responsible for : Rehabilitation proposals
Production of drawings and graphics to be included in reports.

- **Professor A.E. van Wyk: Botanical Survey**

Subsequent to the compilation of the initial team a need was identified for additional hydrological expertise in the team. The Department of Agricultural Engineering of the University of Natal was approached and a team of hydrological specialists were added to the initial team. The purpose of

the above group was to perform a hydrological analysis of the runoff from the catchments of the proposed reservoirs and to compute the water budgets for the proposed dams.

1.4. ALTERNATIVES

Regulations 8(b) of Regulations R1182 made in terms of the Environmental Conservation Act, No 73 of 1989, stipulate that an Environmental Impact Report must contain a comparative assessment of all the alternatives considered during the Environmental Impact Assessment.

Eskom has performed an assessment of all areas that may possibly have an appropriate site for the construction of a pumped storage scheme. Several possible sites were identified, most situated along the South African escarpment. From this portfolio of potentially viable sites three sites were selected for prefeasibility and feasibility studies. These three sites are:

- Steelpoort in Mpumalanga;
- Mutale in the Northern Province; and
- Braamhoek which is situated in two provinces namely: KwaZulu-Natal and the Free State.

Recent studies found adverse geological conditions at the Mutale site. Therefore, the Mutale site is not considered to be feasible for the development of a pumped storage scheme. Subsequently a possible site, Impendle, approximately 65km most of Pietermaritzburg was identified for feasibility studies. These studies include an Environmental Impact Assessment.

Alternatives were not considered during this study and no such discussion is included in this report. The reasons for the deviation from protocol are as follows:

- The physical requirements of pumped storage schemes with regards to height elevation between the reservoirs, water supply, vertical distance between reservoirs and base rock formation is such, that specific sites only, can be considered. The position of reservoirs, shafts, surface buildings and tunnels is therefore fixed within narrow parameters, leaving no option for the assessment of alternatives.

The approach followed during this assessment is rather to identify "fatal flaw impacts" that will prohibit the development of the selected site. Furthermore, where no "fatal flaw impacts" exist, to identify significant impacts and to conceptualise adequate mitigation measures. Mitigation measures will be included in the final design of the project, as well as in the construction and operational procedures of the proposed project.

Furthermore, it must be stressed that the three prospective schemes, namely Braamhoek, Steelpoort and Mutale, currently investigated by ESKOM, are not alternatives to one another. If feasible all three or only one of the above may be constructed.

1.5. BRIEF ENVIRONMENTAL DESCRIPTION

This brief environmental description is intended to orientate the reader with regards to the environment and geographic location of the proposed development. For further detail and the comprehensive specialist reports the reader is referred to Annexure A (Volume II).

The proposed site for the Braamhoek Pumped Storage Scheme is situated 23 km northeast of Van Reenen on the farms Braamhoek and Bedford. The study area forms part of the uTukela Regional District and is situated on the boundary of Kwa-Zulu Natal and the Free State. The area falls within the Drakensberg escarpment. The upper reservoir is on the head water tributary of the Wilge River, which flows into the Vaal River System. The lower reservoir is in the headwater of the Klip River, which in turn flows south-eastwards into the Tugela River. Maps indicating the location of the proposed scheme are included in Annexure C: Scoping Report (Volume III).

The uThukela Regional District includes the following magisterial districts:

- Klip River;
- Bergville;
- Okhahlamba;
- Weenen; and
- Estcourt.

For purposes of the Socio-Economic Assessment the following areas were delineated as part of the primary study area:

- Watersmeet;
- Driefontein;
- Kirkinthulloch;
- Peace Town;
- Burford; and
- Surrounding rural areas.

The area considered for the agricultural study was broadly described in three groups:

- Riparian farmers along the Wilge River, from the site of the upper reservoir at Bedford, along the Wilge River to where the Wilge River crosses the N3 at Swinburne;
- The Riparian farms along the Braamhoekspruit from the lower reservoir, to the Windsor dam; and
- The areas of Driefontein, Watersmeet, Vulandondo, Peace Town and Burford.

The other study groups, hydrology, ecology, botany, etc. concentrated on the sites to be directly affected by the proposed development. However, the interaction between the proposed sites and surrounding environment was considered at all times.

1.6. PROJECT DESCRIPTION

1.6.1. Locality

The Braamhoek Pumped Storage Scheme is located 23km Northwest of Van Reenen on the farm Braamhoek, near Chatsworth. The attached locality and layout plan, Annexure C: Scoping Report (Volume III), indicate the important dimensional and technical aspects of the project. Poltech in association with a multi-diciplinary team of specialists performed the Environmental

Impact Assessment. Composition of the team of specialists is given in paragraph 1.3. of this report.

The Braamhoek PSS is planned to have a live volume of 25,5 x $10^6 m^3$ for the operation of the pumped storage scheme and a dead storage of 2 x $10^6 m^3$ in each reservoir. The full supply level would be at 1738,5 meter amsl for the upper and 1270,3 meter amsl for the lower reservoir.

1.6.2. Technical Information

a. Introduction

A pumped storage scheme utilises surplus electricity generation capacity on the Eskom system during off-peak hours to pump water from the lower to the upper reservoir and release this water again during peak load hours to generate electricity. A pumped storage scheme thus relieves the need for other peaking plant such as gas fired turbines to meet peak loads and also relieves the need for the switching off of coal fired generation during periods of low power system load.

This practice increase the expected life of coal fired generation units, in addition to the reduction in nett pollutants and waste generated during periods of peak load demand.

The proposed scheme consists of two dams, interconnected by enclosed tunnel systems, with pump turbine units with a potential generation capacity of approximately 1000 MW.

b. Alternative Technology

The selection by Eskom of a Pumped Storage Scheme (PSS) as the most appropriate technology to supplement the national power grid during peak demands was prompted by a feasibility study conducted by Eskom over the past 15 years.

The primary reasons given for proposing a PSS are:

- Pumped storage schemes improve the efficiency of the electricity grid by storing surplus energy during periods of lower demand and releasing this energy during periods of high demand.
- It is cheaper than importing additional electricity.
- Switching coal fired power stations off during low demands and re-starting them during high demands is ineffective and costly.

Although no other alternatives are as effective as pumped storage schemes in the sense that they store surplus energy and re-produce it when it is really required, possible alternative technologies for producing peak energy are conventional hydro-electric plants, gas fired turbines and in lesser extent the importation of electricity. Conventional hydro stations require large quantities of renewable water while the operating cost and environmental impacts of gas fired turbines are relatively much higher. There are currently no existing hydro sources outside our borders which in their present state will be available as a source of peaking power in the quantities required by Eskom in the future. Pumped storage is therefore regarded as the most appropriate option.

Table I summarised the main advantages and disadvantages of pumped storage schemes.

TABLE I: ADVANTAGES AND DISADVANTAGES OF PUMPED STORAGE SCHEMES

Advantages	Disadvantages
Has quick start capability and is therefore extremely effective in supplying peak power	The cycle efficiency is approximately 75 % i.e. it uses 25 % more energy from the national grid than it releases back to the grid.
Consumes surplus energy, thereby “smoothing” out the load curve and allowing base load plant to operate closer to their optimum constant full load.	The dams could have a negative environmental impact.
Except for small operating losses, a pumped storage scheme does not consume water once the reservoirs are filled. The same water is used over and over again.	
It is very cost effective and reliable.	Relatively long (approximately 6 years) construction period.
It is pollution free and generates no waste.	
Can be combined with a water supply transfer scheme.	
Assists in the adjustment of the power factor to control the voltage of the national power grid.	

Most of the power plant is situated below the ground.	

c. Technical Information

During the prefeasibility study and report compiled by Eskom, a range of technical information was compiled. The most important information relevant to this report is the following:

- **Upper reservoir:**

Location:	28° 15'S & 29° 35'E
Farm:	Bedford
Drainage region:	C161
Hydrological Zone:	Z 1
Catchment area:	10,606 km²
Mean annual precipitation: (MAP)	947mm
Mean annual run-off: (Virgin MAR)	1,358 x 10^6m³
Natural average flow on which down-stream Riparian owners can depend:	0,084 x 10^6m³/annum
Evaporation:	1,759 x 10^6m³/annum
Sediment yield area:	10 606 km²
Sediment accumulation:	1 637 m³
Flood analysis – Regional Maximum Flood:	245 m³/sec

- **Lower reservoir:**

Location:	28° 19'S & 29° 35'E
Farm:	Braamhoek
Drainage region:	V024
Hydrological Zone:	Z10
Catchment area:	60,756 km²
Mean annual precipitation: (MAP)	1015mm
Virgin Mean annual run-off: (Virgin MAR)	14,016 x 10^6m³

Natural average flow on which	
down-stream riparian owners can depend:	1,404 x 10^6 m³/annum
Evaporation:	1,759 x 10^6 m³/annum
Sediment yield:	150t/km²/annum

Another important technical aspect, which is of relevance to the environmental assessment, is the Initial Filling Regime of the upper and lower reservoir.

Two possible alternatives were considered for this aspect, namely:

- Only catchment inflows, and
- Supplementary inflow from the Wilge River.

The first alternative may pose a potential problem in priming the system upon completion of the scheme. The small catchment of the upper reservoir may not contain sufficient volumes of water for the priming of the scheme, while the lower reservoir is already full. The prefeasibility report further states that should the upper reservoir be completed later than the lower, the volume in the upper reservoir would be even less than required. It was also concluded that the initial filling of the system during a drought situation, cannot be completed within an acceptable period of time, if it is only depending on the runoffs from the catchment areas of the two reservoirs.

Therefore, a further alternative was considered during the pre-feasibility study, namely the filling of the system via supplementary inflow from the Wilge River.

The maximum pumping rate of the system with all three proposed turbines in operation is 180m^3/second. It is therefore possible to supplement the water in the upper reservoir with water from the lower reservoir, once the latter has filled to the required dead storage volume of 2 X 10^6m^3.

d Facilities Required:

i. Permanent facilities and structures

- Upper reservoir: Rockfill with either a concrete or an asphalt upstream facing.
- Lower reservoir: Roller Compacted Concrete.

Both reservoirs will have outlet facilities to release water back into the existing streams.

- Penstock and Pressure Shafts
- Pipeline routes
- Power pylons
- Structures – surface buildings, pump station, powerhouse, tunnels, weirs etc.
- Access routes
- Substation
- Residential facilities: Approximately 100 permanent residences to be constructed in Ladysmith

ii. Temporary facilities and structures required only during the construction phase

The estimated construction time is six (6) years. Exploratory work, including exploratory tunnels and geotechnical testing, as well as building of access roads will start 18 months ahead of the main construction work.

The construction yard will have a surface area of 1Ha at the upper reservoir site (Bedford) and 8Ha at the lower reservoir site (Braamhoek).

In addition to the construction yard, a temporary village will be constructed at each reservoir site. The proposed villages will be situated 0,5 to 1km from the upper reservoir site, and 1 to 2km from the lower site. The facilities indicated in Table II will be provided at the above villages.

TABLE II: COMPOSITION OF TEMPORARY CONSTRUCTION VILLAGES – BRAAMHOEK PUMPED STORAGE SCHEME

Description	Upper Reservoir site	Lower Reservoir site
Content of construction Village		
Residential		
Family accommodation	X	X
Single accommodation	X	X
Commercial		
Shopping and canteen	X	X
Banking		X
Post Office		X
Filling station	X	X
Fire station	X	X
Township admin	X	X

Description	Upper Reservoir site	Lower Reservoir site
Social		
Education		X
Health		X
Library		X
Church		X
Policy station		X
Tavern/Pub	X	X
Recreation		
Passive		X
Active		X
Entertainment		X
Industrial		
Township maintenance	X	X
Vehicle maintenance	X	X
Vehicle depot	X	X
Storage	X	X
Infrastructure		
Access	X	X
Internal roads	X	X
Water & power reticulation	X	X
Sewage reticulation and disposal	X	X
Refuse/waste disposal	X	X
Security	X	X

In addition to the above the following facilities will also be developed.

- Borrow pits outside dam basin
- Spoil dumps
- Waste sites
- Temporary roads

1.7. PUBLIC PARTICIPATION PROCESS

A summary of the Public Participation Process that was followed during this Environmental Impact Assessment follows in this section of the report. However, a comprehensive report on this process is attached to the report as Annexure B (Volume III).

1.7.1. Introduction

Because of the nature of the communities involved the Public Participation Process was conducted in two parts; namely:

- In the traditionally commercial agricultural areas of the riparian farmers of the Wilge-, Braamhoek- and Klip rivers; and
- Amongst the traditional black rural communities in the study area.

The process with the commercial farmers were divided into three parts; namely:

- Pre-visit identification. From 1:50 000 maps all riparian farms along the Wilge River from Bedford 389 to the N3 crossing, as well as those farms along the Braamhoekspruit from Oulston 8510 and Braamhoek 14 497 to Walkershoek 1224 and Windsor Dam along the Klip River, were identified.

  A Deeds Office search was performed of the above farms to identify the owners and the possible subdivisions.

  These farms and their owners were then included in the participation process.

- Field visits were made to the identified owners. During these visits farmers were informed of the proposed development, and their inputs were gathered. An assessment of agricultural activities in the study area was made at the same time. A formal questionnaire was used to gather the information.

- An awareness meeting was held with the commercial farmers as a follow-up to the field visit. The meeting was held for all commercial land owners, SAPS units and agricultural unions in the study area. This included agricultural unions of other farmers in the study area not directly classified as riparian farmers. The proposed scheme was introduced by senior Eskom personnel. An overview of the EIA process and preliminary issues were given. Questions and issues were discussed.

Issues raised by the above community are the following:

- Influx of people during construction could lead to an increase of theft from farms;
- The scheme should lead to upgrading of infrastructure such as roads and telephone services;
- Local labour would be employed. This may lead to disparity in salaries currently paid and future expectations;
- Possibility of coal mines developing in the area. (It was explained that the proposed scheme does not utilise coal as a source of energy); and
- Flow of the rivers must be maintained at least at current levels.

It was agreed with the community that a feedback session will be held once the specialist studies were completed.

1.7.2. Traditional Rural Black Communities

For these communities an extensive participation process, comprising of several phases, were followed. The phases of the process are discussed below:

a. Pre-Fieldwork

Preparation consisted of planning of the awareness creation process and compilation of a questionnaire. The first activity was to establish an organisational structure of the community, in order to establish the social composition of the community. The current leader structure, as well as existing community enhancement programs were also determined

The leadership in each community was consulted with regards to the proposed public participation process to be followed for the Eskom Pumped Storage Scheme. Agreements were made with the accepted leadership of communities on the public participation process to be followed.

b. Areas included in the Public Participation

The following rural communities were identified in consultation with the local leadership to be included in the public participation process; namely:

- Peacetown;
- Embuzweni;
- Watersmeet;
- Burford; and
- Vulandondo.

c. Awareness Meetings

Successful awareness meetings were held in the mentioned communities. Each meeting was attended by more than 500 people.

The extent and location of the proposed Braamhoek Pumped Storage Scheme was discussed during each meeting. The extent of the Environmental Impact Assessment was also conveyed to the meetings.

Once the above information was shared with each meeting the floor was opened for discussion. The issues and expectations raised during the meetings by the communities are the following; namely:

- Creation of employment opportunities;
- Availability of employment opportunities to all communities in the area;
- Impact of proposed reservoirs on grazing lands and properties of people;
- Employment opportunities for women;
- Provision of water from the proposed reservoirs;
- Start date of project;
- Leadership in construction/project village, if this was to be build;
- Employment process to be followed; and

- Training to be given to people employed during the construction and operation of the scheme.

d. Field work

i. Training

A total of sixty field workers were recruited during the public meetings. The field workers were trained in the contents of the questionnaire, technical information regarding the proposed scheme and how to conduct an interview. The training included practical sessions in a controlled environment to ensure that each fieldworker has the required level of competence.

ii. Management

The field workers were managed by a person selected from the community. This person was given additional training with regards to the management and administration of field workers.

iii. Response

A total of 733 questionnaires were completed. Each questionnaire represents a household and not a single person. Questionnaires were analysed by the Socio-Economic Specialist Group.

iv. Conclusions

From the analysis results of the questionnaires the following conclusions were made with regards to the public participation process, and the proposed pumped storage scheme:

- The public participation process was comprehensive and successful;
- Field workers performed their tasks competently;

- The community is not negative towards the proposed development;
- Proposed development is seen as a creator of employment opportunities; and
- There is a need for vegetable production within the community. Growing of vegetables is hampered by a lack of irrigation water.

1.8. INSTITUTIONAL INTERESTED AND AFFECTED PARTIES

This section is a summary of the process followed during the consultation of Institutional Interested and Affected Parties (II & AP's). Detail information is included in Annexure B, Volume III of this report.

A comprehensive list of Institutional Interested and Affected Parties (II & AP's) was compiled by the EIA project team. The above list included I & AP's that reside in the region of the proposed development site, as well as II & AP's that may have on interest in the site but are not necessarily represented in the region.

The proposed project was introduced to all the identified II & AP's by means of a letter (See Annexure B, Volume III). Reply was received from one II & AP's only, namely Rennies Wetlands Project.

The original list of II & AP's was again approached on 6 October 1998. The purpose of the second contact was to determine interest amongst II & AP's to attend a site visit. A response was received from one I & AP's only, namely Rennies Wetlands Project. Unfortunately the latter II & AP's could not attend the site visit on any of the two proposed dates. It was agreed that the above II & AP's will be supplied with a copy of the Environmental Impact Report for comment.

Subsequently contact was established by Dr Rick Nuttall from the Ornithology Department of the National Museum in Bloemfontein. Dr Nutall was in contact with Dr Allan Batchelor, EIA specialist team leader – Wetlands. Inputs were made by Dr Nuttall to Dr Batchelor during the EIA process.

Dr Barry Taylor, Zoology Department – Natal University, registered as an II & AP in May 1999. He will review the EIA report for comment.

1.9. AUTHORITY PARTICIPATION

Contact was established with Mr Danie Smith, Assistant Direct: Environmental Impact Regulations, of the Department of Environmental Affairs and Tourism, on 16 February 1998. Mr Smith recommended that the application be submitted to both the Department of Environmental Affairs and Tourism, Free State Provincial Administration, as well as the Department of Traditional and Environmental Affairs, KwaZulu-Natal. Pre-application meetings were held with the Free State Provincial Authority on 23 March 1998, and with the KwaZulu-Natal Provincial Authority on 14 April 1998. Applications with Scoping Report were submitted to the mentioned authorities on 19 May 1998.

Poltech (Pty) Ltd was requested by the Free State Provincial Authority to contact the National Department of Environmental Affairs and Tourism on 20 August 1998. A meeting was arranged with Stephanie Le Hanie on 18 September 1998. At this meeting Me Le Hanie was comprehensively informed with regards to the extent of the project and the status of the EIA. A copy of the Scoping Report was also handed to her.

Contact was also established with Mr Jeremy Cooke from the Department of Water Affairs and Forestry in Ladysmith.

Independently from this specific EIA, Eskom maintain formal contact with the Department of Water Affairs and Forestry. During a meeting of the Department of Water Affairs and Forestry, Directorate: Land, Planning & Survey – Pietermaritzburg, in Ladysmith, Eskom was requested to register the interest of the above Department in the Braamhoek project. Subsequently a letter was received by Poltech (Pty) Ltd from the above Department registering this interest.

Telephonic contact was maintained with all of the above parties during the EIA process.

On 20 March 1998 the Uthukela Regional Council replied in writing to a questionnaire distributed in the region as part of the Public Participation Program. The letter and completed questionnaire requested that Councillors from the Regional Council be involved in the Public Participation Process. It was confirmed that the Councillors were already involved in the process to date and will remain part of the process.

Mentioned authorities were contacted and invited to the site visit arranged for I & AP's on 9 November 1998. Representatives from Department of Water Affairs & Forestry, and Provincial Department of Environmental Affairs (Free State) attended the site visit and information day on 9 November 1998. A representative from the Free State Directorate of Nature Conservation also attended the day.

2.0. SIGNIFICANCE DESCRIPTION OF IMPACTS

2.1. SIGNIFICANCE DESCRIPTION METHODOLOGY

The **significance** of Environmental Impacts were assessed in accordance with the following method:

Significance is the product of probability and **severity**. **Probability** describes the likelihood of the impact actually occurring, and is rated as follows:

- Improbable - Low possibility of impact to occur either because of design or historic experience.
  Rating = 2
- Probable - Distinct possibility that impact will occur.
  Rating = 3
- Highly probable - Most likely that impact will occur.
  Rating = 4

- Definite - Impact will occur regardless of any prevention measures.
  Rating = 5

The **severity rating** is calculated from the *factors* given to **intensity** and **duration**. Intensity and duration factors are awarded to each impact, as described below.

The **Intensity factor** is awarded to each impact according to the following method:

- Low intensity - natural and man made functions not affected - Factor 1

- Medium intensity - environment affected but natural and man made functions and processes continue - Factor 2

- High intensity - environment affected to the extent that natural or man made functions are altered to the extent that it will temporarily or permanently cease or become disfunctional - Factor 4

Duration is assessed and a *factor* awarded in accordance with the following:

- Short term - ≤1 to 5 years - Factor 2

- Medium term - 5 to 15 years - Factor 3

- Long term - impact will only cease after the operational life of the activity, either because of natural process or by human intervention - Factor 4.

- Permanent - mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient - Factor 4.

The **severity rating** is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below. For example:

The Severity factor = Intensity factor X Duration factor
= 2 x 3
= 6

A Severity factor of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

TABLE III: SEVERITY RATINGS

Rating	Factor
Low Severity (Rating 2)	Calculated values 2 to 4
Medium Severity (Rating 3)	Calculated values 5 to 8
High Severity (Rating 4)	Calculated values 9 to 12
Very High severity (Rating 5)	Calculated values 13 to 16
Severity factors below 3 indicate no impact	

97-3111.09A 27 44 13 13 1 30 06 99

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating.

The significance rating should influence the development project as described below:

- Low significance (calculated Significance Rating 4 to 6)
  - Positive impact and negative impacts of low significance should have no influence on the proposed development project.

- Medium significance (calculated Significance Rating ≥6 to 15)
  - Positive impact:
    Should weigh towards a decision to continue
  - Negative impact:
    Should be mitigated to a level where the impact would be of low significance before project can be approved.

- High significance (calculated Significance Rating 16 and more)
  - Positive impact:
    Should weigh towards a decision to continue, should be enhanced in final design.
  - Negative impact:
    Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least low significance rating.

2.2. ANTICIPATED IMPACTS

From the specialist studies, see Annexure A (Volume II), a list of anticipated impacts was compiled. This list was in no order of priority. A workshop attended by all the lead consultants were held to perform a Significance Assessment of the identified impacts. Each identified impact was assessed in detail according to the methodology described in section 2.1. of this report. The possibility of synergistic and secondary impacts was considered by the group during the above assessment. Table IV, p39, contains the results of the significance assessment.

The anticipated environmental impacts associated with the proposed Braamhoek Pumped Storage Scheme are the following, namely:

2.2.1. Beneficial Impacts

a. **Economic Impacts**

i. Construction of the pumped storage scheme and improvement of the access road and other infrastructure will benefit the regional economy during the construction phase.

ii. Construction of the pumped storage scheme will stimulate the economy of the RSA, and will have a greater positive net impact on the national economy.

iii. The construction of the scheme will lead to an increase in GGP, employment, and taxes in the regional economy. The largest impacts will be on GGP, with a total increase of approximately R1,45 million per annum as a result of the main construction phase and increased employment opportunities of approximately 19 852.

The economic sectors that might benefit the most in the region, due to the increase in GGP, are the construction– and manufacturing sectors. Increase in employment opportunities will occur in the manufacturing-, agricultural- and construction sectors.

iv. During operational phase the main economic impact is on the national economy. Annual contribution from the scheme towards the national GNP is R478 million.

v. Only 60 permanently employed persons are required to operate the scheme during the operational phase. However, annual additional employment opportunities in the region is estimated at 2 987 due to the multiplier effect.

vi. During the construction phase 600 unskilled labourers will be recruited. If an average income of R1 500-00 per month is used, total income per annum as a result of the construction, of the scheme (plant, village and roads) could amount to approximately R11 million.

This increase in income would have spill-over effects on expenditure levels, and demands for additional services. Total increase in buying power due to construction amounts to approximately R3,6 million per annum.

vii. During the operational phase the total increase in personal income in the region could increase to approximately R4,6 million per annum, with a total buying power of approximately R1, 7 million per annum.

b. Agriculture

i. Agriculture can be supported during the implementation and construction phase by developing vegetable gardens for the construction personnel and leave the infrastructure to the local population for their continued use. There is a considerable need for food production at rural settlements like Driefontein that could be satisfied by support programmes that may flow from this project.

c. Infrastructure and Community Services

i. Primary schools are well represented in the region in terms of their number. However, the standard of schools is uncertain. In the Klip River Magisterial District the population is

characterised by high illiteracy levels, which contributes to the existing economic position of the population, since they are unable to compete for better job opportunities.

However, the increased number of children expected in the area during construction will require at least one additional primary school and three additional pre-school facilities.

ii. Construction workers will require an additional 350 560m^2 of residential development with an average stand size of 500m^2.

iii. Minor increase in retail space would be required in the region during the construction phase of the proposed scheme. In total, approximately 322m^2 of additional retail space would be required.

iv. During the construction phase the proposed scheme should generate approximately R1 171 636-00 per annum of income to the local authority. Total income per annum of approximately R283 636-00 will be generated by the local authorities from the scheme during the operational phase.

v. During the operational phase of the proposed scheme the residential development required is, 21 182m^2 for semi-skilled employees and 31 773m^2 for skilled employees.

vi. An assessment of the current skills level amongst the local people in the region conclude that the following skills are available to be utilised during the construction phase of the proposed scheme:

- Drivers;
- Builders;
- Store workers/clerks;
- Security personnel;
- Welders;
- Electricians;
- Plumbers; and
- Machine operators.

The above persons do require additional training for the skills to be utilised.

vi. The road conditions in the study area can mostly be classified as medium, with the majority of the roads being gravel roads. During periods of rain the roads to the proposed reservoir sites become almost unusable. Construction of the scheme, as well as operation would require access roads to be upgraded substantially.

2.2.2. Adverse Impacts

a. Archaeology and Cultural Heritage

i. The cave on the farm Bedford shows signs of inhabitation by Late Stone Age Humans. The rock art in the cave has unfortunately been damaged. No previous scientific excavation of this site was made. The cave will be submerged in the waters of the top reservoir of the proposed development.

ii. Some graves were identified on the properties proposed for the location of the two reservoirs. At this stage no graves were identified in the actual basement area of the proposed reservoirs, neither in the area that would house surface structures associated with the scheme. However, it is possible that such graves and even sites of archaeological value may be exposed during the construction of the proposed development.

b. Hydrology

i. Building of a reservoir in the Bedford Catchment (Upper Reservoir) would significantly effect the water supply of the Wilge River from the Bedford subcatchment. Although the effect of the reservoir on the Mean Annual Runoff (MAR) is relatively little in the Braamhoek catchment, 7,3 %, the effect would be significant in the Bedford catchment, namely 26,1 % reduction.

Note: The recommendation paragraph of the hydrology section of the CSIR Environmental Report (Annexure A, No 6.0., Volume II) contains a statement regarding development in Class A river

catchments. In the above statement it is written that in the opinion of the author the upper reservoir (Bedford) would be situated in a pristine catchment. Furthermore, that the pristine catchment would be classified as a Class A river, and that development in such a catchment would not be possible.

The above statement describes a possible fatal flow. It therefore requires specific assessment of the situation. The issue was discussed with various officials of the Department of Water Affairs and Forestry, namely

- *Mr Haroon Korodia;*
- *Mr E Bofilatos; and*
- *Mr Neil van Wyk.*

From the above discussions the following were concluded:

- *Guidelines on the classification of river catchments are currently (June 1999) being compiled. No such guidelines have been published;*
- *Classification as a Class A catchment will not automatically prohibit any development in such a catchment;*
- *Development in Class A catchment will be subject to provisions. These provisions will be based on ecological and public requirements. Provisions will therefore be specific for each situation.*

In the specialist Agriculture Report (Annexure A, No 3.0., Volume II) it is concluded that the Bedford catchment is not in a pristine condition. It is therefore possible that the catchment may not be classified as Class A.

However, even on the assumption that the catchment would be classified as Class A, it does not exclude development. Provisions that may be imposed in the above scenario would be based on

ecological and public requirements. Both of these issues were considered during this EIA. Mitigation measures and recommendations to ensure compliance to ecological and public requirements are included in the Environmental Management Plan (Volume IV).

c. Fauna

The study on the terrestrial fauna of the area conclude that the mammals, reptiles, insects and birds that occur in the specific areas to be inundated by the two proposed reservoirs, would be able to move to alternative sites without any adverse effect on the populations. This conclusion is based on the following:

- Species observed/expected in the study area are not endangered;
- Large areas of similar habitat are available in the region; and
- Low population pressure on the available habitat.

d. Flora

i. No vegetation communities and plant species of special conservation and/or scientific importance were identified in the study area. A few species of ornamental value occur at both of the proposed reservoir sites, notably geophytes.

ii. Soils at the proposed reservoir sites are highly erodable and a rather sparse vegetation cover is evident due to the overgrazing and trampling by domestic animals.

iii. Vegetation at the lower reservoir site is particularly prone to infestation by alien invasive plant species, specifically *Acacia dealbata and Acacia mearnsii.*

iv. Afro-montane forest occurs against the slopes of the Drakensberg Escarpment between the upper and lower reservoirs. The mentioned forest covers less than 0,2 % of the total surface of South Africa, yet it is the essential habitat for may species of plant and animal.

The Braamhoek Forest Complex is known as Montane Podocarpus Forest (Yellow wood) and covers about 51,3 ha. This is the third largest complex of this forest type in kwaZulu-Natal and is therefore of considerable conservation significance. The Afro-montane forest will not be affected by construction of the reservoirs and/or tunnel system, as not surface works occur in this area.

e. Riparain/Aquatic Ecology and Water Quality

The assessment of the riparian and aquatic ecology of the proposed site of the Braamhoek Pumped Storage Scheme concentrates on the upper reservoir site as the lower reservoir basin site has been extensively modified by agricultural practices.

The impacts listed below therefore only apply to the upper reservoir site, namely Bedford.

i. The wetlands on the proposed upper reservoir site, Bedford, will be inundated and therefore permanently lost. In addition, the impoundment will also effect a portion of the wetlands down stream of the upper reservoir. The above secondary impact result from changes in the water quality and quantity released from the Braamhoek sub-catchment to wetlands down stream.

ii. The loss of habitat will impact on the amphibian, fish and invertebrate population on the site of the upper reservoir. It is likely that the construction of the dam will change the biodiversity of the mentioned groups. However, currently it is believed that no species with a high conservation status is endemic in the study area.

Of interest at the Bedford site, upper reservoir, is the presence of an isolated population of an unidentified Barbus species. A population of this fish species exists in the stream draining the eastern section of the catchment above the waterfall. It is unknown how long this population has been separated from those occurring in the river below the waterfall. It is conceivable that this population has been separated from the parent population for sufficient time to possibly be recognised sub-species or even a new species.

An interesting find in the ephemeral wetlands associated with the outcropping soundstone plates was the presence of the fairy shrimp *Branchipodopsio natalensis*. The type locality for this species was recorded as the Van Reenen area, and the presence of these invertebrates at this site is regarded as important in terms of the classification and identification of fairy shrimps in South Africa.

iii. Results of analysis of water samples collected in on the Braamhoek and Bedford sites indicate a significantly higher concentration of calcium, sodium, potassium and magnesium at the Braamhoek site compared to the Bedford site. Hardness and alkalinity (measured as $CaCO_3$) were also higher in the water collected from the Braamhoek (lower reservoir) site.

It is conceivable that the concentrations of the measured elements may change seasonally. It is anticipated that the turbidity and sediment load in the Braamhoek (lower reservoir) spruit will increase during the summer rainfall periods.
Supplementation, and mixing during the operation of the proposed scheme, of the water in the upper reservoir with water from the lower reservoir may cause changes in the water quality in the upper reservoir. The changes in water quality could adversely affect the wetlands areas downstream from the upper reservoir.

f. Avifauna

The atlas-derived bird list for the ¼°square 2829BA total 223 species. Most of these could be expected to occur at the dam site, given the homogeneous nature of this square with respect to altitude, biome/vegetation type and landscapes. In field trips made to the dam site, 77 bird species were recorded, six new to the square. From these lists, and from an assessment of the habitats represented at the dam site, it is predicted that 36 conservation-worthy species are likely to occur at this site, some as resident breeding species, others as regular or erratic visitors. Fifteen of these were recorded there during the field trips and the others are assumed to occur, at least occasionally. Three are ‘critically endangered’, one is ‘endangered’, six are ‘vulnerable’, six are ‘at risk’, ten are ‘near-threatened’, five are ‘endemic’ and five are ‘near endemic’.

This is a high incidence of conservation-worthy species to be found in a single area of such a limited extent. The strong representation of threatened/near-threatened avifauna is testimony to: the relatively pristine, undisturbed and untransformed landscape in which the site is located, an environment in which such species are most likely to occur. The area lies in the grassland biome which, because of its large-scale transformation, supports a high incidence of threatened species; and the upper Bedford, reservoir site contains extensive areas of natural grassland and unaltered wetlands, both critical habitats for may of the target species.

Not all 36 target species are resident in the area: some would be non-breeding summer visitors (e.g. Lesser Kestrel, Pallid Harrier), or regular, year-round, non-breeding visitors (e.g. Bald Ibis, Cape Vulture); some would be erratic visitors (e.g. Bearded Vulture, Martial Eagle), or only occasional visitors (e.g. Wattled Crane, Corncrake). But at least six species (and probably 8-9) are likely to occur here as breeding residents: Crowned Crane, African Marsh Harrier, Grass Owl and Stanley's Bustard, Blue Crane and Yellowbreasted Pipit (in the grasslands). Other possible breeding species are Whitebellied Korhaan, Blue Korhaan and Blackwinged Plover. The Bald Ibis is listed above as a non-breeding visitor but its status would change to breeding resident if, during the next breeding season, if it could be confirmed that the cliffs at the waterfall, currently used as a roost, are also used by this species for nesting.

The 'critically threatened' Whitewinged Flufftail was not detected at the dam site (it being very difficult to detect outside its main calling period) but the two wetlands in the proposed dam basin are structurally and floristically suitable for this species. It is likely to occur here, given that Taylor (1997) located this species in the large wetlands on Chatsworth which adjoins the lower wetland on Bedford. This same lower wetland may also support a small population of the 'critically endangered' Bittern which occurs on a few structurally similar wetlands in KwaZulu-Natal. It is also a difficult species to detect and it was not recorded.

Should the instream flow requirements of the Wilge River be ignored, the proposed reservoir at Bedford would have a significant impact on the wetlands downstream of it. Under such conditions the impact of the Bedford reservoir on the Avifauna of the area would have an impact

rating of 72 *(using the scoring system in the specialist report on the Avifauna included in Annexure A)*, compared to a score of 5 for the lower Braamhoek reservoir.

g. Agriculture

The following environmental impacts were identified during the assessment of agriculture in the study area.

i. Stabilised water flow in the riparian systems may be a secondary result of the reservoirs. This may stimulate a shift in production systems which in turn may result in environmental degradation.

ii. During the construction phase labour instability may occur in the region due to the disparity that will exist between the salaries of agricultural labourers and construction workers.

iii. Building of the reservoirs will have a dramatic impact on the farming units of Braamhoek and Bedford farms. The loss in the case of Braamhoek is R695 200-00 of a current revenue of R1 007 250-00, and at Bedford R586 180-00 out of a current revenue of R948 000-00. The mentioned loss of revenue will cause the above farming units to be non-viable.

iv. Intensified agricultural activities that may result from the development will promote increased use of agrochemicals. Chemicals such as fertiliser, pesticides and herbicides can be detrimental and could determinedly effect the environment if not handled with care.

h. Pollution

iv. The construction of the proposed reservoirs would require cutting and preparatory ground works at the construction sites. This would cause a non-typical landscape and lead to a visual impact.

v. Upgrading of the roads, as well as construction of the scheme would require the development of borrow pits. Material claimed from borrow pits will be used for rockfill, and aggregate. These borrow pits could have an aesthetic impact on the environment.

vi. Indiscriminate disposal of waste rock from tunnelling activities will cause an aesthetic impact on the surrounding environment.

iv. Disposal of construction waste may lead to pollution of air, soil and water. The waste dumping site may contain the following waste:

- Solid waste: building rubble; redundant material; domestic waste;
- Liquid waste: lubricants; solvents; paints;
- Airborne waste: dust from earth works; smoke from fires; emissions from vehicles and temporary plant.

v. Construction activities will cause noise, such as that emanating from vehicles and blasting work. This noise may be disturbing to people in the surrounding environment. However, both proposed reservoir sites are isolated and situated at a considerable distance from persons that may be affected.

vi. During the operational phase, domestic waste will be generated on site. Disposal of this waste by landfill may lead to soil, air and water pollution.

vii. Illumination of construction site and the scheme, once it is in operation may cause lights to be visible from a distance. This source of pollution reduces the experience of visitors to the area and may therefore be unacceptable to tourists visiting the area, as well as to the local inhabitants of the area.

2.3. SIGNIFICANCE ASSESSMENT

The impacts identified by each specialist group, as discussed in section 2.2. above, were assessed by the study team collectively during a workshop session. The results of the above significance assessment are reflected in Table II.

TABLE IV: RESULT OF THE SIGNIFICANCE ASSESSMENT OF THE IMPACTS IDENTIFIED TO BE ASSOCIATED WITH THE BRAAMHOEK PUMPED STORAGE SCHEME

Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating
		Intensity	Duration			
BENEFICIAL						
1. Construction phase. Benefits to regional economy due to improved roads and village. 2.2.1.a. (i.)	5	4	2	8	3	15 Medium
2. Construction of scheme positive impact on national economy, 2.2.1.a.(ii)	5	4	2	8	3	15 Medium
3. Construction will have a positive impact on the regional economy.2.2.1.a.(iii) (iv)	5	4	2	8	3	15 Medium
4. Additional employment opportunities during operational phase 2.2.1.a.(v)	5	1	4	4	2	10 Medium
5. Employment opportunities during construction increase household income, taxes and buying power in the region. 2.2.1.a.(vi) (vii)	5	4	2	8	3	15 Medium
Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating
		Intensity	Duration			
6. Support of agriculture during construction, building capacity in the community to produce food in the future. 2.2.1.b.(i)	4	2	2	4	2	8 Medium
7. Increased requirement for primary school in the area and three pre-schools. 2.2.1.c.(i)	4	4	3	12	4	16 High
8. Additional residential development required during construction, as well as during operation. 2.2.1.c.(ii) & (v)	5	4	3	12	4	20 High
9. Generation of additional income to the local authorities from taxes and rates during the construction and operational phases. 2.2.1.c.(iv)	5	2	3	6	3	15 Medium
10. Currently there are skills in the area that could be utilised during the construction and operational phases of the project. 2.2.1.c.(vi)	5	4	2	8	3	15 Medium
ADVERSE IMPACTS						
11. Archaeological and cultural value of cave at upper reservoir site.2.2.2.a.(i)	3	2	4	8	3	9 Medium
12. Occurrence of graves to be moved on the proposed construction sites. 2.2.2.a.(ii)	2	2	4	8	3	6 Low
13. Effect of the proposed upper reservoir on the water supplied from this catchnent to the Wilge River in stream water flow.	4	4	4	16	5	20 High

2.2.2.b.(I)						
14. Impact on terrestrial fauna. 2.2.2.c.	3	1	4	4	2	6 Low
15. Flora species in basins of reservoirs to be retained. 2.2.2.d.(i)	3	1	4	4	2	6 Low
16. Soils highly erodable due to sparse vegetation cover. 2.2.2.d.(ii)	4	2	3	6	3	12 Medium
17. Infestation of proposed site by alien species, especially lower site. 2.2.2.d.(iii)	4	2	4	8	3	12 Medium
18. Effect on Afromontaine forest on slopes between two reservoirs. 2.2.2.d.(iv)	2	4	3	12	4	8 Medium
19. Loss of wetland in upper reservoir basin, and basin bellow.2.2.2.e.(i)	5	4	4	16	5	25 High
20. Affect amphibian and invertebrate species due to the construction of the upper reservoir. 2.2.2.e.(ii)	5	2	2	4	2	10 Medium
21. Effect the fish species that occur in the area of the upper reservoir. 2.2.2.e.(ii)	5	4	4	16	5	25 High

Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating
		Intensity	Duration			
22. Changes in the water quality of the upper reservoir due to mixing with water from the lower reservoir, this may impact on the wetlands at the upper reservoir. 2.2.2.e.(iii).	3	2	4	8	3	9 Medium
23. Impact on the construction of the proposed reservoirs on the Avifauna of the area, especially the upper reservoir. 2.2.2.f.	4	2	4	8	3	12 Medium
24. Stabilised water flow from the reservoirs may cause a change in the agricultural production along the rivers; this may lead to environmental degradation. 2.2.2.g.(i)	4	4	3	12	4	16 High
25. During and shortly after construction labour instability may occur in the region, especially amongst farm labourers. 2.2.2.g.(ii)	5	4	2	8	3	15 Medium
26. Impact of the building of the reservoirs on the farming units of Braamhoek and Bedford farms. 2.2.2.g.(iii)	5	4	4	16	5	20 High
27. Increased use of agrochemicals may have an impact on the environment. 2.2.2.g.(iv)	3	2	2	4	2	6 Low
28. Current road conditions would not support the construction and operation of the proposed scheme. 2.2.1.c.(vii)	5	4	4	16	5	25 High
29. Impact on the environment from the earth works of the proposed reservoirs and scheme. 2.2.2.h.(i)	5	2	3	6	3	15 Medium
30. Borrow pits to be developed for the construction of roads and infrastructure. Unrehabilitated borrow pits would lead to erosion and have a negative aesthetic impact on the area. 2.2.2.h.(ii)	5	2	4	8	3	15 Medium
31. Disposal of waste rock from the development of the tunnelling system will have a negative aesthetic impact on the area.2.2.2.h.(iii)	5	2	4	8	3	15 Medium
32. Disposal of construction related waste would have an impact on the environment as it could cause air, soil and water pollution. 2.2.2.h.(iv)	5	4	3	12	4	20 High
33. Construction activities may cause disturbing noise in the environment. 2.2.2.h.(v)	5	1	3	3	2	10 Medium

Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating
		Intensity	Duration			
34. Disposal of domestic waste during the operational phase could lead to soil, water and air pollution and thereby have an effect on the environment. 2.2.2.h.(vi)	5	2	4	8	3	15 Medium
35. Illumination, initially of the construction site and later of the operational site, may cause light pollution. Light pollution effect the sense of place of an area, which in turn could effect the tourist potential of the area, as well as be an annoyance to permanent residence of the area. 2.2.2.h.(vii)	4	4	4	16	5	20 High

Note:

- The number given at the end of the impact description refers to the relevant paragraph in section 2.2. of the report. Refer to indicated paragraphs and specialist report (Annexure A Volume II) for detail.
- Medium impacts of an adverse nature should be mitigated, beneficial impacts of medium significance should be managed to ensure maximum environmental gain.
- Adverse impacts with a high significance should influence the project designs and philosophics to prevent the impact from occurring.
- Beneficial impacts with a high significance rating should weigh towards a decision to continue with the project.

3.0. DISCUSSION

Eleven impacts with a High significance were identified during the Environmental Impact Assessment. Of the above eleven impacts, nine are Adverse Impacts, and two are Beneficial Impacts. The nine Adverse Impacts with a high significance are the following:

- Effect of the proposed upper reservoir on the water supplied from the Bedford sub-catchment to the Wilge River;
- Loss of wetlands in the upper reservoir basin, and basin bellow;

- Effect on fish species, *Barbus*, that occur in upper reservoir area;
- Stabilised water flow from the reservoirs may cause a change in the agricultural production along the rivers; this may lead to environmental degradation.
- Impact of the building of the reservoirs on the farming units of Braamhoek and Bedford;
- Current road conditions would not support the construction and operation of the proposed scheme;
- Disposal of construction related waste; and
- Illumination of the construction site and operational site may cause light pollution.

All of the above impacts, with the exception of the loss of wetlands, could be adequately mitigated.

The construction of the upper reservoir will lead to a loss of a small percentage of the wetlands in the area of the upper reservoir. These wetlands are well represented throughout the upper region of the Drakensberg escarpment. Loss of the relatively small area of wetlands due to the construction of the proposed Bedford (upper) reservoir should therefore not lead to a loss in unique habitat or any endangered, threatened or rare species of fauna and flora.

In total 21 impacts with a Medium Significance were identified. Of these 13 are adverse – and eight are beneficial impacts. Of the 13 adverse impacts one impact can not be mitigated in total, namely:

- Effect on amphibian and invertebrate species due to construction of the upper reservoir.

No endangered species of amphibians and invertebrate were identified in the area of the proposed upper (Bedford) reservoir. Although a change in the specie diversity in the area will occur due to the construction of the upper reservoir, this will not lead to any loss of amphibian or invertebrate species.

4.0. CONCLUSION

From the findings and results of the Environmental Impact Assessment it is concluded that the development of the proposed Braamhoek Pumped Storage Scheme on the environment is beneficial.

Furthermore, that associated adverse impacts could be reduced to acceptable levels by the implementation of mitigation measures.

5.0. EXPLANATORY PHOTOGRAPHS

The report is illustrated with a set of twelve photographs taken during an aerial survey of the proposed site.

97-3111-09A

ESKOM GENERATION GROUP

ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED BRAAMHOEK PUMPED STORAGE SCHEME

VOLUME II OF IV:

ANNEXURE A: SPECIALIST STUDY REPORTS

C O N T E N T S

1.0. INTRODUCTION

Each specialist report contains a comprehensive discussion of the specific environment characteristic it deals with, as well as conclusions and recommendations regarding anticipated impacts. The impacts describe in each Specialist Report were reviewed by the full EIA team. During this review possible synergistic and secondary impacts were considered and a significance assessment was performed. Impacts that require mitigation were identified. Recommendations regarding mitigation measures are included in the Environmental Management Plan (Volume IV).

2.0. SOCIO-ECONOMIC PROFILE AND IMPACTS

3.0. AGRICULTURE

4.0. CULTURAL AND HISTORIC RESOURCES

5.0. HYDROLOGY

6.0. WETLANDS AND AQUATIC SYSTEMS

7.0. BOTANICAL SURVEY

8.0. POLLUTION, SOIL, AIR, WATER, NOISE, AND AESTHETIC

8.1. PURPOSE

The purpose of this report is to reflect the findings of an assessment of pollution (soil, air, waste, noise and aesthetics) associated with the proposed Braamhoek Pumped Storage Scheme.

8.2. STUDY AREA DESCRIPTION

8.2.1. Location

The proposed Braamhoek Pumped Storage Scheme is situation 23 km northeast of Van Reenen on the farms Braamhoek and Bedford. The proposed development consist of two dams, inter connected by enclosed tunnel systems. The one dam to be situated on the farm Bedford (Upper Reservoir) and the other on Braamhoek (Lower Reservoir). The site of the upper reservoir is on the head water tributary of the Wilge River, which flows in to the Vaal River System. The lower reservoir is in the headwater of the Klip River, which in turn flows south-eastwards into the Tugela River.

8.2.2. Topography

The topography of the proposed site is typical of the Drakensberg escarpment. The upper reservoir site is situated at an altitude of 1700m and consists of rolling grassland, with incised drainage lines. Resistant sandstone layers on the site has lead to the formation of two waterfalls. Bellow the waterfalls extensive wetlands do occur.

The lower reservoir (Braamhoek is situated in the foothills of the Drakensberg escarpment at an altitude of 1220m, in typical grassland with rolling hills.

8.2.3. Water quality

Analysis of water samples collected during this assessment indicate that the water chemistry in the upper and lower reservoir areas differ. The results of the analysis of water samples collected in April 1998 are given in Table 8.1.

TABLE 8.1.: RESULTS OF WATER SAMPLES COLLECTED IN APRIL 1998

Parameter	Analysis Results			Water Quality Agricultural Use
	Bedford Sample 1	Bedford Sample 2	Braamhoek	
Nitrate	0,03	0,0	0,0	0-100(1) 20-175(3)
Chloride	3,6	4,0	4,0	0-1500(1)
Alkalinity	7,0	10,0	29,0	20-175(3)
pH	6,5	6,8	7,5	6,5-8,4 6-9
Turbidity	0,9	9,8	11,4	N/S
TDS	32	52	76	25-80(3)
Potassium	0,4	0,4	0,8	
Sodium	1,6	2,4	4,4	0-2000(1)
Magnesium	0,08	0,25	2,14	0-500(1)
Calcium	0,5	1,1	5,6	0-1000(1)
Hardness	1,7	3,8	22,3	20-175(3) mg/*l*N Calcium carbonate

(1): Water quality guidelines for livestock watering.

(2): Water quality guidelines for irrigation (Class I).

(3): Water quality guidelines for freshwater aquaculture.

N/S: Not standard

Concentrations in mg/*l*N

The standards reflected in Table 8.1. were taken from the South African Water Quality Guidelines(1). Seasonal changes may occur in the values reported for the parameters measured as part of this assessment.

8.2.4. Air

The proposed site is situated in an area that is distant from any major services of air pollution. The site is

The site is therefore not significantly subjected to air pollution imported from other regions.

8.2.5. Noise

The site is remote from any industrious, mining, agricultural activities, or infrastructure that may cause a noise nuisance.

8.2.6. Soils and Land Cover

The topsoil layer of the study area consists of Red and Yellow dystrophic/mesotrophic soils, while the subsoil horizon are made up of Upland duplex/margallitic soils.

Vegetation cover in both the proposed reservoir sites is poor, and erosion during stormwater runoff may occur. However, the Environmental Potential Atlas for South African [(2)] indicate the area as low to average susceptibility to erosion.

8.2.7. Aesthetic Value

The Drakensberg escarpment is known as an area of scenic value in the Environmental Potential Atlas for South Africa[(2)].

8.3. ANTICIPATED ENVIRONMENTAL IMPACTS

8.3.1. Soil Pollution

Although the proposed development is known to be "clean" technology associated activities do generate waste. In discriminate disposal of waste may lead to soil pollution.

However, soil pollution that may occur should remain localised as the waste streams are not anticipated to generate large volumes of waste. Typical waste streams anticipated to occur are the following:

- Domestic Waste from the Construction Village as well as the Construction Site and Operational Plant;
- Construction Waste generated during the construction of the scheme. This waste stream include rock from tunnelling operation, waste material such as concrete, steel, wood, etc;
- Vehicle lubricants generated from construction vehicles; and
- Fuel spilled unto soil at construction vehicle service areas.

The only significant waste stream in terms of volumes is the construction material waste stream. Most of this waste could be used in the lining of the reservoirs.

Domestic waste will initially during construction be high volumes. The volumes will, however, reduce to insignificant levels during the operational phase of the project.

Soil pollution associated with spillages of lubricants and fuel would be highly localised and low volume.

Shallow soils that occur on the proposed upper reservoir area (Bedford) will inhibit the use of landfill as an onsite disposal method for domestic waste.

8.3.2. Air Pollution

The air at the proposed sites of the Braamhoek Pumped Storage Scheme is of a high quality due to the absence of major air pollution source in the area, as well as the fact that no air pollutants are imported to the area from sources in neighbouring regions.

Once in operation the proposed scheme will not generate any air pollutants. However, localised air pollution may occur during the construction phase. The pollutants that may be released into the atmosphere during construction will be liberated from ground level sources. Dispersion is therefore not anticipated to occur to any forming or residential units in the area. Typical sources are anticipated to be as follows:

- Vehicle exhaust fumes released from construction vehicles;
- Dust liberated from earth works and vehicle movement; and
- Cooking and heating fires in the construction village may release smoke.

Typical pollutants to be released may therefore be as indicated in Table 8.2.

TABLE 8.2.: TYPICAL POLLUTANTS THAT MAY BE RELEASED FROM CONSTRUCTION ACTIVITIES, AS WELL AS RECOMMENDED ENVIRONMENTAL LIMITS

Source	Pollutants	Recommended Environmental Limits
i. Vehicle exhaust fumes	Carbon monoxide	0,5ppm(2)
	Carbon dioxide	100ppm(2)
	Lead	2,5 micrograms/m^3
ii. Dust liberated from earth works/vehicles on roads	Particulates	100 micrograms/m^3 (1)
	Particulates	100 micrograms/m^3 (1)
iii. Cooking and heating fumes	Carbon monoxide	0,5ppm(2)
	Carbon dioxide	100ppm(2)
	Smoke	100 micrograms/m^3

(1): Recommended Exposure Limits as determined by the Chief Air Pollution Control Officer - Department of Environmental Affairs and Tourism.

(2): $1/50^{th}$ of Threshold Limit Values determined by the American Conference of Governmental Industrial Hygienists.

Predominant winds are from the sector west-north-west to north, as well as from east to south-south-east sectors (as measured at Van Reenen). Pollutants released from the construction activities at the proposed sites will therefore be dispersed in a southerly to east-south-easterly direction, as well as a northerly to north-westerly direction. The closest residents to the proposed site in the affected directions is the community of Driehoek. Driehoek is at least five kilometres from the Lower reservoir site. It is therefore unlikely that ground level concentrations of the pollutants released from the construction site will reach or exceed the levels given as guidelines in Table 8.2.

8.3.3. Water

Both the proposed reservoir sites are situated in the head waters of rivers that feed into supply waters of large metropolitan communities and agricultural areas. It is therefore important to protect the sources from pollution generated by the operation of the scheme, as well as the initial construction.

Possible pollution of surface and ground water during the construction phase will be related to the disposal of waste, inclusive of solid waste, liquid waste and sewage, as well as increased siltation of surface water due to the removal of vegetation cover during earthworks. Sufficient dilation of pollutants and deposition of silt should occur to reduce the risk to downstream users and ecosystems.

However, the pollution of water from in the upper catchment areas of any river system should be reduced to as low as possible.

During the operation of the scheme water from the lower Braamhoek reservoir will be pumped into the upper Bedford reservoir. The hydrological studies performed by the Department of Agricultural Engineering of the University of Natal, included as section 5 of Annexure A of this report, it can be concluded that the lower reservoir should fill within sixteen to seventeen months.

The upper reservoir will in the same period only fill to more or less 25 % of its capacity. A large percentage (75 % and more) of the water used to prime the scheme initially will therefore originate from the lower catchment area. During the operational life of the scheme it can be expected that the lower catchment area will contribute more towards the total water volume in the system. The water in the upper reservoir, and released to the users and ecosystem downstream, will therefore be a mixture of water originating from the Bedford and Braamhoek catchments. The water chemistry of the water released from the Bedford catchment will therefore change from the current situation towards that of the Braamhoek catchment, see Table 8.1. for detail of current situation. The current water chemistry in the two catchments are similar, except for the hardness and turbidity. It can be expected that hardness and turbidity of the water in the upper reservoir will change from current levels to higher values.

The current quality of the water in both the Bedford and Braamhoek catchments, as determined from samples collected in April 1998, complies to the guidelines compiled by the Department of Water Affairs and Tourism. Total Dissolved Solids (TDS) was the only parameter measured to be more than 50 % of the guideline value. The TDS in the Braamhoek catchment was 44 % higher than the average level measured in the Bedford catchment. The TDS and turbidity of the water in the Bedford (upper) reservoir may therefore increase significantly upon mixing of the water in this catchment with water from the Braamhoek (lower) catchment.

Water hardness (0-75mg/*l*, soft; 75-100mg/*l*, moderately hard; 150-300mg/*l*, hard; 7300mg/*l*, very hard) is an important constituent which plays a significant role in asmo regulation. Gill permeability ? with an increase in water hardness. Water hardness also affects the intake and toxicity of certain metals. The acute toxicity of heavy metals is in many instances less in hard water. Therefore, water hardness can influence the survival and growth rate of aquatic animals. Water hardness of 300mg/*l* and more should be avoided. The hardness of the water in the Bedford (upper) reservoir is not expected to reach the level of moderately hard (75-100mg/*l*), when under conditions of mixing with water from the lower Braamhoek catchment.

The level of TDS in the upper Bedford reservoir will increase with the influx of water from the lower Braamhoek reservoir upon priming of the system. Levels are expected to increase higher than the level of 76mg/*l* measured in the Braamhoek catchment. This is expected due to seasonal

changes in siltation that occur. Siltation in summer months, October to February, with high rainfall would be higher than during periods of less rainfall. However, it is unlikely that levels will increase by more than 200 % therefore a TDS level of 228mg/*l*. A TDS level of 228mg/*l* is not expected to have any sublethal affects on aquatic life, these affects include increased microheamatocrit red blood cell counts, influence on production and delayed hatching of eggs. The mentioned affects are only expected from TDS levels of 400mg/*l* upwards.

8.3.4. Noise

Construction activities such as operation of equipment and vehicles, blasting and material preparation may generate noise. However, sufficient attenuation will occur over the 5km distance to the closes residential buildings for such activities not to cause any noise nuisance.

8.3.5. Aesthetic or Visual Impacts

The permanent structures of the proposed pumped storage scheme would not have an aesthetic impact on the surrounding environment. This conclusion is based on the fact that the largest structures, the reservoirs, are considered to be aesthetically pleasing, as well as the relative small extent of surface buildings associated with the generation system of the scheme.

However, security lighting at night could be unacceptable to persons visiting the area as ecotourists.

Removal of structures associated with the construction of the scheme, as well as temporary roads, camps, storage areas and borrow pits may result in areas devoid of vegetation cover and irregular in shape. Such areas would be considered to be aesthetically unacceptable to people visiting and residing in the area. Such areas would also susceptible to erosion and thereby cause siltation and pollution of surface water.

8.4. CONCLUSION

From the findings of this assessment the following is concluded.

8.4.1. Disposal of domestic waste during the operational and construction phases may cause soil pollution.

8.4.2. Construction waste may lead to soil and visual pollution if it is disposed indiscriminately.

8.4.3. Servicing and refuelling of construction vehicles and motorised equipment on site may cause localised soil pollution.

8.4.4. Emissions of pollutants into the atmosphere during both the construction and operational phase does not pose a risk to the health of persons in the area or to the environment.

8.4.5. Disposal of waste during the construction and operational phases of the proposed project could lead to pollution of surface and ground water.

8.4.6. Mixing of the water from the Braamhoek (upper) catchment with water from the Braamhoek (lower) catchment would lead to changes in the water chemistry of the water released from the reservoir in the upper catchment. Changes in water chemistry should not have a significant impact on the ecosystem or users downstream from the proposed Bedford (upper) reservoir.

8.4.7. Construction and operation of the proposed development should not cause a noise nuisance in the surrounding environment.

8.4.8. Permanent structures associated with the proposed development should not cause a negative aesthetic or visual impact.

8.4.9. Light pollution associated with security illumination at the permanent structures of the proposed development could be unacceptable visually to persons visiting the area.

8.4.10. Areas distributed by temporary structures or usage during the construction phase would be visually unacceptable. Such areas could also be subjected to increased erosion, leading to a greater aesthetic impact, as well as water pollution by siltation.

8.5. REFERENCES

8.5.1. South African Water Quality Guidelines, Department of Water Affairs and Forestry, 1993. Printed by the Government Printer, Pretoria (ISBN 0-621-15461-X).

8.5.2. Environmental Potential Atlas for South Africa, The Department of Environmental Affairs and Tourism, J.L. van Schaik, Pretoria, 1997 (ISBN 0-627-02315-0).

9.0. FAUNA

9.0. PURPOSE

The study of this report is to reflect the findings of an assessment of the potential impact on fauna associated with the proposed Braamhoek Pumped Storage Scheme.

9.1. STUDY AREA DESCRIPTION

This assessment focus on the possible impact on the fauna of the proposed sites of the two reservoirs and surface buildings, i.e. farms Bedford and Braamhoek. This section of the report does not assess the impact on bird life, nor aquatic fauna, these impacts were assessed and reported separately.

The proposed development sites are situated in rolling hill grassland typical of the Drakensberg escarpment area. Both sites, Bedford (upper reservoir) and Braamhoek (lower reservoir) were subjected to agricultural ? production activities for an extended period time. The large mammal species that have occurred naturally in the area are therefore disturbed. Current populations are under pressure of habitat invasion by agricultural activities. No large mammal species were observed during any of the numerous site visits performed during the study period. It should be noted that the proposed reservoirs have at maximum capacity a surface area of 389ha and 350ha for the Bedford (upper) and Braamhoek (lower) reservoirs respectively. It would be possible for mammals to migrate from the area to be submerged to neighbouring areas. Furthermore, once in operation, the proposed scheme is a low activity plant with no noise, emission, effluent and little traffic associated to it. Disturbance will therefore be insignificance.

The Drakensberg area is recognised in the South African Red Data Book as one of seven sensitive areas that contain the majority of threatened hupetofauna. Of the eight taxa of threatened status recorded to the Drakensberg area the distribution of three coincide with the location of the proposed development. These three taxa are the following, namely:

i. Spiny Crag Lizard

- Although restricted must of its range is inaccessible and well protected (SA RDB 1988)
- Range – Lower slopes (1500-2500m) of the Drakensberg, from Giant's Castle in Natal to Golden Gate in OFS (Branch 1994).
- Habitat – Scattered boulders in open grassland.
- Existing Conservation Measures – Protected in Natal of OFS by provincial Ordinance. Recorded from a number of protected reserves, including most of the Natal Drakensberg reserves and the Golden Gate National Park in the OFS.

ii. Striped Harlequin Snake

- Very little is known about this very rare, minute snake (Branch 1994).
- Range – Highveld, extending to Natal Midlands.
- Habitat – Grassland

iii. Breyer's Longtail Seps

- Rare according to SA RDB.
- Range – SE Transvaal and adjacent Natal and OFS (Branch 1994)
- Habitat – Mountain grassland.

The proposed reservoir sites do not contain any locality specific plant community. It is therefore unlikely that any rare or endangered insects will occur on the proposed reservoir sites, as these two components are closely associated with each other.

9.2. CONCLUSION

From the observations, investigations, field visits and interviews performed during this assessment, the following conclusion are made.

9.2.1. No endangered, rare or sensitive mammal, herpetofauna or insect species occur on the proposed Reservoir sites.

9.2.2. Sufficient similar habitat exist in the area for species to migrate to should they experience pressure during the construction phase of the project.

9.2.3. A pumped storage scheme is a low activity operation and should not place any pressure on species in the environment once it is commissioned.

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ESKOM GENERATION GROUP

ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED BRAAMHOEK PUMPED STORAGE SCHEME

VOLUME III OF IV:

ANNEXURE B: PUBLIC PARTICIPATION AND AWARENESS

ANNEXURE C: SCOPING REPORT

C O N T E N T S

ANNEXURE B: PUBLIC PARTICIPATION AND AWARENESS

INSTITUTIONAL INTERESTED AND AFFECTED PARTIES (II & AP'S)

1.0. INTRODUCTION

At the onset of the EIA it was recognised that II & AP's include organisations geographically distributed over a large area. The usual approach of holding interest group meetings on site, or in the area of the proposed site, would have been ineffective. Therefore, a strategy of direct contact was followed during this EIA.

2.0. FIRST CONTACT

A list of II & AP's were compiled with input from all members of the specialist team. Contact details for II & AP's were obtained and a letter introducing the proposed project, as well as an information leaflet were posted to all II & AP's. In the case of the policing structures in the region of the proposed site personal contact was made during the fieldwork amongst the commercial farmers and rural black community.

The II & AP's included in the above first contact correspondence are the following; namely:

- Natal Parks Board, Dave Johnson – P O Box 662, Pietermaritzburg, 3200
- Overberg Crane Group, Wicus Leeuwner, P O Box 541, Caledon, 7230
- Poison Working Group, Gerhard Verdoorn, P O Box 72334, Parkview, 2122
- Renfreight (Rennies) Wetland Project, David Lindley, P O Box 44344, Linden, 2104
- Seekoeivlei Nature Reserve Memel, P O Box, 236, Memel, 2970
- South African Crane Foundation, Charles Byron, P O Box 905, Mooi River, 3300
- South African Crane Working Group, Lindy Rockwell, Private Bag X11, Parkview, 2122

Copy of letter attached to this report.

Policing structures and agricultural organisations contacted in the region are the following, namely:

- SAPD – Van Reenen, Insp. P Nel
- SAPD – Harrismith, Supt. Morce
- SAPD – Capt. Jacobs
- Besters Agricultural Union – Mr T de Jager
- Swinburne Agricultural Union – Mr K Odendaal
- Van Reenen Agricultural Union – Mr J Boshoff

3.0. REPLY ON FIRST CONTACT

Commercial farmers replied via questionnaires distributed during visits. This process is described in section 1 of this Annexure.

3.1. RENNIES WETLANDS PROJECT

Correspondence was received from Rennies Wetland Project only. The correspondence was received on 24 June 1998, following the initial letter send by Poltech (Pty) Ltd on 12 June 1998. A further letter was received from Rennies Wetland Project on 8 September 1998. The latter letter requested specific information. This was forwarded as requested. Correspondence attached to this report.

3.2. ORNITHOLOGY DEPARTMENT OF THE NATIONAL MUSEUM IN BLOEMFONTEIN

Rick Nuttall, of the Ornithology Department of the National Museum in Bloemfontein and Chairman of Bird Life South Africa, contacted Eskom directly with a request for information on the proposed project in March 1998. Mr B Stroud responded on behalf of Eskom to Rick Nuttall on 24 March 1998 and notified Poltech (Pty) Ltd of the above request on 25 March 1998. Contact was established with Mr Nuttall telephonically on 30 March 1998.

At a project meeting on 15 April 1998 the request was discussed and correspondence with detail information, as per his request, was forwarded to Mr Nuttall on 29 April 1998. A copy of the

mentioned letter was also faxed to Mr Nuttall on 30 April 1998. Direct line of communication was established between Mr Nuttall and Dr Batchelor, the scientist leading the team that assessed the impacts on bird life associated with the proposed project.

4.0. SECOND CONTACT

II & AP's were invited on 6 October 1998 to a site visit on 9 November 1998. The invitations were made telephonically and per fax. Although several II & AP's indicated interest in attend, none confirmed and none attended the site visit. The site visit took place on 9 November 1998 as per invitation.

5.0. ZOOLOGY DEPARTMENT, UNIVERSITY OF NATAL – PIETERMARITZBURG

During May 1999 Barry Taylor of the Zoology Department University of Natal Pietermaritzburg contacted Poltech (Pty) Ltd requesting information on the status of the Braamhoek EIA. During the telephonic discussion between Barry Taylor and Mr W Lombaard (Poltech) it was agreed that Mr Taylor would review the EIA report that would be made available in Pietermaritzburg.

AUTHORITY PARTICIPATION

1.0. INTRODUCTION

This EIA was planned and initiated before the publication of the statutory requirements regarding Environmental Impact Assessments on 5 September 1997. The process and methodology followed do conform to the principles contained in the mentioned regulations.

However, in the evaluation of the documentation and process it should be considered that this EIA dates before the regulations of 5 September 1997.

2.0. PRE-APPLICATION CONTACT

2.1. 16 February 1998 – Discussion with Mr Danie Smith, Assistant Director: Environmental Impact Regulations. Mr Smith recommends that provincial authorities of the Free State and KwaZulu Natal be approached. National Authority was kept informed by means of contact with Me S Lehani.

2.2. 23 March 1998 – Contact with Department of Environmental Affairs and Tourism, Free State. Discussion held with following officials:

- R S Khadi;
- M Mokoela;
- Z Zituta;
- T S Mahema; and
- S Barkenhuizen.

Introduce project and receive application form.

2.3. 14 April 1998 – Contact with Me S Allen Chief Directorate, Environmental Affairs, Department of Traditional and Environmental Affairs, KwaZulu-Natal. During the meeting the project is discussed in detail, as well as the intended EIA process. Receive application form.

3.0. APPLICATION

Applications containing the required information, as well as Scoping Reports, are submitted to the provincial authorities of KwaZulu-Natal and Free State on 9 June 1998.

Notification of Receival of application is received from Free State Provincial Administration on 29 June 1998, signed by R Khadi.

4.0. COMMENTING AUTHORITIES

A list of commenting authorities was compiled by the project team in June 1998. On 12 June 1998 a letter is send to all commenting authorities. The letter introduce the project to these authorities and contains an Awareness Creation Document, as well as contact details of EIA team.

Above letter was forwarded to the following authorities:

- Tugela Vaal Government Water Scheme, Mr J L Hough, Private Bag X1652, Bergville, 3350
- Directorate: Land, Planning & Survey, Mr R Hoole, Private Bag X9123, Pietermaritzburg, 3200
- Regional Director, DWAF, Mr J G Hansman, P O Box 1018, Durban, 4000
- TWP Office, Mr J Cooke, P O Box 2584
- KwaZulu-Natal Town & Regional Planning Commission, Mr G Atkinson, P O Box 88, Hilton, 3245

Mr Cooke replied telephonically and registered his interest. A correspondence requesting information was received from Mr K R Legge, Social and Ecological Services, Department of

Water Affairs and Forestry on 10 July 1998. Information requested in the above letter is contained in this EIA report. Mr Legge is notified accordingly and is to review and comment on this report.

On 20 March 1998 the Uthukela Regional council reacted in writing to a questionnaire distributed in the region as part of the Public Participation Program. The letter and completed questionnaire requested that Councillors from the Regional Council are involved in the Public Participation Process. It was confirmed that the Councillors were involved in the process to date and will remain part of the process.

5.0. SITE VISIT

On 6 October 1998 an invitation was extended to authorities to attend a site visit on 9 November 1998. The invitation was send to the following authorities, namely:

- National Department of Environmental Affairs and Tourism – Me S Le Hanie
- Provincial Department of Environmental Affairs and Tourism – Free State – Mr R Khadi
- KwaZulu-Natal Department Traditional Affairs and Environment – Me S Allen
- DWAF – Mr J Cooke
- DWAF – Mr K Legge
- Department of Local Government & Housing KwaZulu-Natal - Vicky Lubbe
- Uthukela Regional Council – Mr C J Rautenbach
- DWAF – Mr J Hansmann

The following persons attended the site visit on 9 November 1998:

- Mr Khadi
- Mr M Collins – Sterkfontein Dam Nature Reserve

- Mr J Cooke
- Mr K Rabie from Eskom Generation Group.

During the site visit the actual dam sites, and campsites were visited.

Comments were received from Mr Collins only. These comments were faxed to Poltech on 23 November 1998. The comments and associated mitigation measures are included in this report.

6.0. AWARENESS DOCUMENT

The document used as an Awareness Creation Document is attached to this report.

7.0. APPLICATIONS

Copies of applications and cover letters are attached.

8.0. COMMENTS ATTACHED TO DRAFT EIR

8.1. Letter received from Department of Water Affairs and Forestry is attached.

8.2. Letter received from Uthukela Regional Council is attached.

8.3. Comments received from Mr M Collins are attached.

9.0. DRAFT ENVIRONMENTAL IMPACT REPORT

A draft Environmental Impact Report (EIR) was compiled. The Draft EIR contained the following, namely:

- Volume I of IV: Environmental Impact Report,
- Volume II of IV: Specialist Study Reports,
- Volume III of IV: Public Participation and Awareness, as well as initial Scoping Report, and
- Volume IV of IV: Environmental Management Plan.

The above Draft EIR was placed in the following locations for review, namely:

- Ladysmith Library (Ms C Bryth)
- Uthukela Regional Council (Ms C J Rautenbach)
- Rennies Wetlands Project (Ms G Borichievy)
- Pietermaritzburg Library (Ms J Bowen)
- KwaZulu-Natal Department of Environmental Affairs (Ms S Allen)
- Free State Department of Environmental Affairs (Mr R Khadi)
- Harrismith Library (Ms A de Jager)

Notification of the availability of the report at the mentioned locations was also send to the following I & AP's, namely:

- SAP Harrismith, Sup. Maree,
- SAP Van Reenen, Insp. P Nel
- SAP Besters, Capt. P Jacobs
- Besters Farmers Association, Mr T de Jager
- Mr E Oats,
- Mr AM Davie,
- Mr G Nel,
- Mr P Geel,
- Ornithology Department National Museum, Mr R Nuttall,
- Seekoeivlei Nature Reserve, Memel,
- Mr RF Dillan,
- Mr GK Hobbs,

- Mr D Coetzee,
- Mr DPR Coetzee,
- Mr DGHF du Toit,
- Mr PJH de Necker,
- Mr C Campher,
- Mr T Filmalter,
- Col D Wessels,
- Dr Reineke,
- Mr B Venter,
- Mr H Botha,
- Mr I Potgieter,
- Mr MJB Khanyik (Snr)
- Mr J Blom,
- Mr JG Smyth,
- Mr TI Kirkness,
- Mr LS Miller,
- Mr G Campher,
- Mr MK Wessels,
- Mr CAT de Jager,
- Mr J Boshoff,
- TWP Office (Mr R Cooke)
- South African Crane Foundation (Mr C Byron)
- KwaZulu Natal Conservation Services (Mr D Johnson)
- Sterkfontein Dam Reserve (Mr M Collins)
- Poison Working Group (Mr D Verdoorn)
- South African Crane Working Group (Ms L Rockwell)
- Regional Director: DWAF-Durban (Mr JG Hansman)
- KwaZulu Natal Town & Regional Planning Commission (Mr G Atkinson)
- Zoology Department – University of Natal (Mr B Taylor)
- Directorate Land, Planning & Survey (Mr R Hoole)

- Tugela Vaal Government Water Scheme (Mr R Hough)
- Department of Water Affairs and Forestry – Pretoria (Mr K R Legge), and
- Mr W Campher.

The cover letters and notification letters send to the above I & AP's indicated that they were granted from 14 July 1999 (date of postage of letters/dispatch of Draft EIR's by Courier) until 18 August 1999 to reply to Poltech (Pty) Ltd with comments.

R J Nuttall responded by letter on 20 July 1999, and confirmed receival of notification letter. Written comments were received from Mr Nuttall on 21 August 1999. These comments are attached to this section of the report.

Dr B Taylor, Department Zoology & Entomology – University of Natal, responded on 29 July 1999 with written comments. These comments are attached to this section of the report.

Mr J Wakelin of KwaZulu Natal Nature Conservation Services (KNNCS) made telephonic contact with Poltech (Pty) Ltd on 3 September 1999. Mr Wakelin indicated that KNNCS requires more time to prepare comments on the Draft EIR. The above requested was also received in writing. As per request the comment period was extended for KNNCS to 30 September 1999. Mr Wakelin requested a copy of the report. A full copy of the Draft EIR was couriered to Mr Wakelin without delay.

On 27 September 1999 Mr Wakelin notified Poltech (Pty) Ltd that KNNCS would require a site visit in order to finalise their comments. The site visit was arranged for 26 October 1999. Consequently a visit to the two dam sites were done on 26 October 1999. The site visit was attended by the following persons, namely:

- KNNCS: Mr J Wakelin, Mr I Rushworth and Mr T Snow,
- Eskom: Mr F Louwinger, Mr K Rabie, and
- Poltech (Pty) Ltd: Mr P J van der Merwe.

During the site visit it was agreed that KNNCS will submit their comments by 15 November 1999. KNNCS requested a copy of the comments already made by Free State Nature Conservation. These comments were forwarded by facsimile on 27 October 1999.

Poltech (Pty) Ltd received letters from Eskom requesting urgent movement on the Braamhoek EIR on 9 November 1999. Copies of above letters were forwarded, under a cover letter, to KZN Traditional Affairs and KZN Nature Conservation Services.

Comments were received from KZN Nature Conservation Services on 8 November 1999. Copy attached.

10.0. COMMENTS

Copies of comments received from I & AP's are attached to this report. Above comments include correspondence received before the circulation of the Draft EIR, as well as comments on the Draft EIA.

In order to facilitate the Record of Decision process (ROD) a note was attached to comments where applicable. The note indicates the section of the EIR and/or EMP that relate to the specific comment.

The following is a list of comments received from I & AP's, namely:

i. Letter from Department of Water Affairs and Forestry (10 July 1998);
ii. Letter from Uthukela Regional Council (20 March 1998);
iii. Comments received from Mr M Collins – Sterkfonteindam Reserve, Department of Environmental Affairs and Tourism Free State (23 November 1998);
iv. Comments by Rick Nuttall on behalf of Bird Life South Africa (21 August 1999);
v. Comments by Dr B Taylor, Department of Zoology & Entomology – University of Natal (29 July 1999); and
vi. Comments by Mr J Wakelin on behalf of KZN Nature Conservation Services.

NOTE: Department of Water Affairs and Forestry.

i. Information requested is included in the Draft EIR, DWAF was given the opportunity to review Draft EIR. No specific comments received from DWAF.

ii. Several personal telephonic discussions on issues related to Braamhoek Pumped Storage Scheme was held with Mr KR Legge of DWAF

NOTE: Uthukela Regional Council.

i. Councillors were involved in community participation program.

NOTE: Department of Environmental Affairs and Tourism, Free State. Sterkfontein Dam Reserve.
Compiled by: Mr M Collins.

1. Aspects mentioned on first page were all assessed. Findings contained in specialist reports, Volume II of IV.

2. The EMP describe several measures to be taken to conserve the vegetation cover in the area. Poltech (Pty) Ltd is an agreement that it is important to restore the vegetation cover where it is currently disturbed, and to protect the vegetation cover.

3. The EMP contains several measures to reduce the impact on bio-diversity, and to support the non-affected wetlands.

4. Concerns regarding water release to the wetland.

It is important to note that the proposed Braamhoek Pumped Storage Scheme is currently in the feasibility assessment phase. Recommendations made by Mr Collins with respect to the release of water from the proposed upper reservoir are currently included in preliminary designs, and engineering models, of the proposed scheme.

These aspects are also included in the preliminary EMP attached to the EIR.

NOTE: BirdLife South Africa. Prepared by RJ Nuttall.
Comments refer to Bedford site only.

1. The statement in paragraph 1 refers. The EIA and EIR compiled by the Poltech (Pty) Ltd team took into consideration all of the environmental characteristics mentioned in the Department of Environmental Affairs and Tourism guidelines on EIA.

2. Extensive consideration is given to potential impacts on the wetlands downstream of the proposed Bedford reservoir. The proposed Bedford reservoir would be positioned in a section of the catchment that is already disturbed by agricultural use, See Section 4 of Specialist Reports.

   The importance of the wetland area downstream of the proposed Bedford reservoir is given priority in the Specialist Report Sections 5 and 6. Based on the above mitigation measures were included in the preliminary EMP. These measures are currently included in engineering models of the proposed scheme, that are used to determine the feasibility of the scheme.

3. The conservation status of the larger Bedford Wetland is recognised in the Specialist Report, Section 6 of Volume II of IV.

4. It should be emphasised that the Chatsworth Reservoir is not part of the planned Braamhoek Pumped Storage Scheme. Furthermore, that the Chatsworth Reservoir is not an Eskom initiative or proposal and is not at all required for the proposed Braamhoek Pumped Storage Scheme. Reference to the Chatsworth reservoir is made in Scoping Report with the sole purpose of providing a point of reference to persons familiar with the Chatsworth Reservoir.

NOTE: Comments received from Dr PB Taylor – Department of Zoology & Entomology University of Natal, Pietermaritzburg.

1. THE GENERAL COMMENTS FROM DR TAYLOR REFERS:

1.1. Dr Taylor had the opportunity to study the Draft EIR, which contains several maps that indicate the precise location of the dams.

1.2. The matter of alternatives are extensively discussed in section 1.4., p8 of 44 of the Environmental Impact Report, Volume I of IV.

1.3. The hydrological impact of the Bedford reservoir was assessed by two separate, independent and unbiased authorities on the topic. The importance of this significant issue has lead to several measures to be included in the preliminary Environmental Management Plan. The above measures are incorporated into engineering models to determine the feasibility of the proposed project.

Several strategics are included in the EMP to monitor the impact of the proposed dam on the wetland downstream.

2. COMMENTS ON VOLUME I.

2.1. The EIR assess the impact on all environmental characteristics with equal importance and do not place biological characteristics above all.

NOTE: Comment from KZN Nature Conservation Services. Prepared by Mr J Wakelin.

1. Comment on road unfounded. EMP contains several measures to be implemented during the construction or upgrading any associated with the proposed project.

2. Increase in population in the area during construction and/or operation is clearly discussed. Issue relating to illegal hunting is comprehensively dealt with in the EMP.

3. The issue relating to the quality of the water released from the Bedford reservoir is extensively included in the EMP.

4. Section 6 of Volume I of IV, contains a comprehensive assessment of the impact on the aquatic biological component of the environment.

ANNEXURE C: SCOPING REPORT

97-3111-09A

ESKOM GENERATION GROUP

ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED BRAAMHOEK PUMPED STORAGE SCHEME

VOLUME IV OF IV: ENVIRONMENTAL MANAGEMENT PLAN

T I T L E P A G E

TITLE	:	ENVIRONMENTAL MANAGEMENT PLAN FOR THE BRAAMHOEK PUMPED STORAGE SCHEME
CLIENT PHYSICAL ADDRESS	:	ESKOM HEAD OFFICE, MEGAWATT PARK, MAXWELL DRIVE, SANDTON.
AUTHOR	:	W.A. LOMBAARD
FIELDWORK	:	SPECIALIST CONSULTANT TEAM
DOCUMENT NUMBER	:	97-3111-09B
DATE OF ISSUE	:	16 MARCH 1999
CLASSIFICATION	:	PUBLIC

C O N T E N T S

VOLUME I

1.0. PURPOSE

The purpose of the Environmental Management Plan is to provide the management team of the Braamhoek Pumped Storage Scheme with a plan to meet both current and future environmental requirements and challenges.

This document is a dynamic document that would require updating as the project progresses through its life cycle. It should therefore be seen as the foundation of an Environmental Management Plan for the Braamhoek Pumped Storage Scheme, and not the end result or complete plan.

1.1. INTRODUCTION

Modern society and legislation demand that environmental consequences of developments are understood and adequately considered in the planning process. ESKOM is committed to the above approach and therefore has commissioned a comprehensive Environmental Impact Assessment (EIA) of the proposed Braamhoek Pumped Storage Scheme. The findings and conclusions of the EIA is contained in an Environmental Impact Report. The above findings and conclusions will be considered by ESKOM during its further feasibility assessment of the proposed development, as well as by authorities during the evaluation of Application to Proceed.

In the event that the proposed development is deemed to be feasible, and it is approved by the authorities, it is essential that negative impact are resolved or mitigated and positive impacts enhanced during the full life cycle of the project. Mentioned mitigation and enhancement of environmental impacts can best be achieved through a formal Environmental Management Plan and Environmental Management System.

The Environmental Management Plan for the proposed Braamhoek Pumped Storage Scheme consists of the following phases.

i. Phase 1: Environmental Impact Assessment. Perform a comprehensive

Environmental Impact Assessment of the proposed development. Identify and evaluate environmental aspects during the above study. Assess the significance of the impact associated with each identified environmental aspect.

Compile possible mitigation and enhancement measures for each identified environmental impact.

However, the identification of "fatal flow" impacts will lead to the decision that the project is not feasible and should be abandoned.

ii. Phase II: Development of Environmental Management System

During this phase a formal Environmental Management System is developed. The system to be based on a traceable standard. Clear Objectives and targets to be identified for each impact.

The Environmental Management System should be designed in such a manner that it could be extended in future to provide for impacts that may arise as the project moves into different life cycles.

This document was developed following the Environmental Impact Assessment of the proposed Braamhoek Pumped Storage Scheme, and as such gives the frame work of the Environmental Management System. The document is based on the South African Bureau of Standards, Code of Practice: Environmental Management Systems – General Guidelines on principles, systems and supporting techniques (SABS ISO 14004:1996). Consideration was also given to the ESKOM Environmental Report 1997.

2.0. COMMITMENT AND POLICY

The Braamhoek Pumped Storage Scheme is planned, designed, constructed, commissioned, operated, decommissioned and dismantled within the framework of the ESKOM Environmental Policy. A copy of the ESKOM Policy should be signed by the project management team to indicate commitment to the document.

The ESKOM Environmental Policy state the following:

ESKOM (Braamhoek Pumped Storage Scheme) will:

- Promote open communication on environmental issues;
- Establish an environmental management system with a view to ensuring continual improvement;
- Contribute towards sustainable development; and
- Educate, train and motivate employees about the environment.

3.0. IDENTIFICATION OF ENVIRONMENTAL ASPECTS AND EVALUATION OF ASSOCIATED ENVIRONMENTAL IMPACTS

The Environmental Impact Report (EIR) prepared by the team of specialists following of the Environmental Impact Assessment should be read in conjunction with this document. The mentioned EIR contains a comprehensive description of the environment, identified impacts, and a significance assessment of impacts.

The above impacts feed into the Environmental Management System.

4.0. INTERNAL PERFORMANCE CRITERIA

The proposed Braamhoek Pumped Storage Scheme function within the ESKOM Environmental Policy.

In terms of the said policy, ESKOM has developed performance criteria to evaluate the environmental achievement of the organisation. The above performance criteria, as stated in the ESKOM Environmental Report 19997, applicable to the Braamhoek Pumped Storage Scheme are summarised in Table I.

TABLE I: ESKOM ENVIRONMENTAL PERFORMANCE CRITERIA

Environmental Resource	Performance Criteria
1. Human Resources	1.1 Staff to be made aware of the need to minimise the negative, and maximise the positive environmental impact associated with the proposed Braamhoek Pumped Storage Scheme.
2. Water Consumption	2.1. Measure water consumption.
	2.2. Implement a Water saving campaign
3. Land	3.1. Maintenance of the site to be done according to good operating procedures related to clearing of vegetation prevention of erosion and continual monitoring.
4. Waste	4.1. Waste register to be developed
	4.2. Hazardous waste to be disposed in compliance with the Occupational Health and Safety Act, No 85 of 1993.
	4.3. Participate in Waste Management.
5. Natural Heritage Sites	5.1. Maintain and strengthen co-operation with NGO's to conserve natural resources.
6. Community Involvement	6.1. Utilise Small, Micro and Medium Enterprises (SMME's) and contractors for environmental – related contracts.

5.0. ENVIRONMENTAL OBJECTIVES AND TARGETS

Environmental objectives and targets are identified for environmental aspects and associated impacts identified and assessed to be significant during the Environmental Impact Assessment. Although in synchronisation with the Eskom Corporate Environmental Policy and Performance Indicators, the objectives, targets and performance indicators described in this document relate to the Braamhoek Pumped Storage Scheme specifically.

Objective, targets and performance indicators were developed for all impacts assessed during the Environmental Impact Assessment to have a medium and high significance rating.

The objectives and targets are designed to reduce or mitigate adverse impacts and enhance beneficial impacts in order to achieve the optimum environmental performance of the Braamhoek Pumped Storage Scheme.

The environmental impacts, as taken from the Environmental Impact Report, and environmental objectives and targets set for each impact is given in Table II.

6.0. ENVIRONMENTAL MANAGEMENT PROGRAM

A comprehensive Environmental Management Program has to be compiled during the detailed planning phase of the proposed project. The above program has to reflect the person responsible for each of the objectives and targets given in section 6 of this document, as well as a time schedule for implementation.

7.0. IMPLEMENTATION AND OPERATION

It is recommended that an Environmental Management System be implemented as soon as the Braamhoek Pumped Storage Scheme progress beyond the feasibility stage. This will ensure that environmental impacts are addressed in a formal manner from the initial phases of the project to its eventual decommissioning.

The Environmental Management System could be based on an international accepted model such as that described in the ISO 14000 documentation.

ANNEXURE A: REQUIREMENTS FOR REHABILITATION

REHABILITATION GUIDELINES:

Rehabilitation of borrow pits and other disturbed areas has the following objectives.

1.1. To meet the Environmental Management Requirements and directives of statutes, such as the Minerals Act, 1991 and its regulations.

1.2. To integrate the objectives and principles of Integrated Environmental Management (IEM).

1.3. To restore the areas used, as borrow pits to a level that is not significantly different from the surrounding environment and that is not in conflict with the land use of the surrounding area.

The above objectives can be achieved by implementing the following guidelines at each borrow pit associated with the construction of the Braamhoek Pumped Storage Scheme.

2.0. SITE PREPARATION

2.1. Vegetation

Trees with a diameter of more than 200mm, as well plants with a conservation value should be counted and their positions indicated on a map of the borrow pit.

2.2. Topsoil

Topsoil is the layer of soil covering the earth and which provides a suitable environment for the germination of seed, allows the penetration of water, is a source of micro-organisms, plant nutrients and in some cases seed. The topsoil must be carefully removed and stored separately at a suitable place so that it can be placed on the exposed soil as soon as the required borrow material has been removed.

The topsoil must be stored in such a way and at such a place that it will not cause damming up of water. If it is used as a water diversion berm the soil must be stabilized by planting a good grass cover on the soil.

The topsoil may not be allowed to wash away during rain events. Hydro seeding or Gel seeding must be used to establish a grass cover. Overburden must be stored separately from topsoil.

The exposure of soil through the removal of vegetation before the commencement of excavations should be limited to that which is essential.

Samples of the topsoil, at least two per hectare, will be taken and used for analysis in order to establish a baseline on the production potential of the soil. Results of soil analysis should be down marked.

2.3. Access roads will be selected and established with the object of minimizing disturbance of the environment. Position of access roads must be indicated on a map of the borrow pit. The landowner must be indicated on a map of the borrow pit. The landowner must agree to the position of access roads by the signing of the above-mentioned map.

Only agreed access roads may be used by personnel and equipment associated with the borrow pit and activities.

2.4. Fences

Borrow pits will be fenced in order to prevent unauthorized access of vehicles, animals and people. The gates to borrow pits must either be locked or guarded by a security guard.

3.0. OPERATION

3.1. At no time may slopes be dangerously steep. Therefore, the slopes of excavations shallower than 1,5m will be finished off so that the gradient is not steeper than 1:3 (about 18 degrees).

Excavations deeper than 1,5m will have a gradient of not more than 1:2 (about 26 degrees). Where the gradient of the slope changes, the finishing off will be done to prevent sharp angles.

Other material piled-up in the borrow pit, such as overburden, will be leveled and covered with topsoil.

3.2. Topsoil piles will not exceed a height of 2 meters and a gradient not steeper than 1:3 (about 18 degrees)

3.3. Surface water

Surface water must be prevented from becoming trapped inside the borrow pit.

Storm water run off must be deflected away from the borrow area. Areas where soil erosion occurs must be repaired immediately.
Visual inspections must be performed at least every two weeks with regard to the following:

- Stability of water control structures
- Signs of erosion and siltation
- Clarity of water canalized to rivers by means of storm water precautionary measures.

3.4. Air pollution

Dust liberation will be minimized by applying the following:

- The absolute minimum of soil should be cleared from vegetation cover

- Exposed soil must be kept damp
- Topsoil stockpiles must be hydro seeded in order to establish a grass cover
- Material stockpiles must be kept to as small a volume as possible
- Material must be handled as little as possible once it is extracted from the pit
- Vehicle traffic on access roads and in the pit must be kept to a minimum

3.5. Soil pollution

Borrow pits may not be used as waste disposal sites. No dumping of any material is allowed in a borrow pit.

Vehicles may not be serviced inside borrow pits. Refueling areas should be covered with an impermeable material (concrete), and enclosed by a bund wall. The volume of the bunded area must be at least equal to 110 % of the total volume of the fuel stored inside the bunded area.

No fires will be allowed inside the borrow pit area.

4.0. CLOSURE

4.1. Topography

Slopes must be finished in order to comply with the requirements stipulated in paragraph 3.1. of these guidelines.

4.2. Topsoil

Stockpiled topsoil will be analyzed at least one month before closure of the borrow pit, in order to establish any deficiencies. Enrichment will be done in order to regain its original production potential before it is used for rehabilitation.
The results of the above analysis will be documented.

4.3. Vegetation

Vegetation will be established that naturally occur in the surrounding area.

Grass will be established through hydro seed treatments of the whole pit area.

At least 110 % of the number of trees that occurred in the pit has to be re-established. A mixture of trees that naturally occur in this area will be used. Trees must be obtained from a reputable nursery. No exotic trees may be established.

Watering and fertilization of trees and grass must be done until the vegetation is well established, for at least 6 months after closure.

4.4. Surface water

Quarries may not be used as dams upon closure. The Department of Water Affairs and Forestry will be notified in cases where the surface owner request the embankment of storm water in a closed, rehabilitated borrow pit. Written approval must be obtained from the above authority before damming of water is done.

4.5. Visual Aspects

After closure of a borrow pit any road not requested by the landowner to be left intact, must be obliterated by breaking the surface crest and planting grass through hydro seeding.

Written consent must be obtained from the landowner on which roads should be rehabilitated, and which should be left. These roads must be indicated on a map, signed by the landowner.

5.0. DOCUMENTATION

Documentation to be kept for each borrow pit is discussed in this paragraph. This documentation must be retained for at least 10 years after closure of borrow pit.

5.1. Photographic Record

A photographic record of each borrow pit will be developed. The record will reflect the condition of the borrow pit before commissioning of preparatory activities, every two weeks during operation and every month for 6 months after closure.

5.2. Map indicating number of trees, position of trees and species of trees, before opening of borrow pit.

5.3. Topsoil analysis before opening of borrow pit, as well as the results of analysis of the soil before rehabilitation. Record of soil enrichment must be kept.

5.4. Map, signed by landowner, indicating access roads to be used.

5.5. Map; signed by landowner, indicating access roads to be left and those to be rehabilitated upon closure of the borrow pit.

5.6. Record of surface water inspections. See paragraph 3.3.

TABLE II: ENVIRONMENTAL IMPACTS, OBJECTIVES AND TARGETS, BRAAMHOEK PUMPED STORAGE SCHEME

Environmental Impact Significance	Objective	Target
BENEFICIAL IMPACTS		
1. Benefit to regional economy due to improved roads and villages (Medium)	1.1. Improve roads and develop village to the best advantage of the surrounding community.	1.1.1. Incorporate requirements of the surrounding community into the design of the improved access roads.
		• Community to be consulted with regards to needs such as access, live stock crossings, etc.
	1.2. SMME's to be made involved in upgrading of the road.	1.2.1. Tasks that are appropriate to be performed by SMME's to be awarded to such organisations.
		Performance Criteria • Analysis tasks associated with road upgrading to be performed to identify projects/contracts to be awarded to SMME's
		• Program in place to identify SMME's
		• Capacity building of SMME's to take place.
		• Identified contracts awarded to SMME's.
	1.3. Village to be re-used to advantage of region.	1.3.1. Village to be designed to be re-used by community upon completion of construction period.
2. Construction of scheme has a positive impact on national economy (Medium).	2.1. Maximum local content to be included in design of scheme.	
3. Construction of scheme has positive impact on regional economy (Medium).	3.1. Local suppliers to be involved in scheme as much as reasonably possible.	

Environmental Impact Significance	Objective	Target
4. Employment opportunities during operational phase (Medium).	4.1. Local employment to be done as far as reasonably possible.	
5. Opportunity to produce agricultural products (Medium).	5.1. Local community to benefit from food required for the construction camp.	5.1.1. Capacity to be build amongst rural black communities in the area to produce agricultural produce, especially vegetables. These to be supplied to construction camp.
		5.1.2. Current commercial farmers to be utilised as sources of agricultural
		Performance Criteria • Basic food products available in the area are sourced from the local suppliers.
		• Suppliers include local block communities and commercial formers.
		• Capacity of black communities to produce food is developed.
6. Increase in household income, taxes and buying power in the region.		
7. Requirement for primary school and three pre-schools (High).	7.1. Facilitate the construction one primary school and three pre-schools in the area that construction workers are recruited from.	
8. Additional residential development required during construction, as well as operation (High).	8.1. Adequate residential area to be developed for employees relocated to site during construction.	
	8.2. Develop residential space in existing town areas for employees involved in separation of scheme.	
9. Additional taxes and rates to local authority during operational phase (Medium).		

<table>
<tr><th>Environmental Impact Significance</th><th>Objective</th><th>Target/Performance Indicators</th></tr>
<tr><td rowspan="2">10. Usage of skills currently in area (Medium).</td><td>10.1. Local skills to be used as much as reasonably possible.</td><td rowspan="2"></td></tr>
<tr><td>10.2. Where required local skills to be enhanced for employment on proposed scheme.</td></tr>
<tr><td colspan="3">ADVERSE IMPACTS</td></tr>
<tr><td rowspan="4">11. Loss of cave with archaeological and cultural value in upper reservoir site (Medium).</td><td rowspan="4">11.1. Conservation of archaeological and cultural value of cave shelter on Bedford reservoir site.</td><td>11.1.1. Appoint archaeologist to document cave shelter comprehensively before it is inundated in water of Bedford (upper) reservoir.</td></tr>
<tr><td>11.1.2. Above document to be placed with a museum to catalogue and preserve.</td></tr>
<tr><td>Performance Criteria
• Cave shelter comprehensively documented by Archaeologist.</td></tr>
<tr><td>• Archaeologist report kept in museum. Document catalogued.</td></tr>
<tr><td rowspan="9">12. Effect of proposed upper reservoir on the water supplied from the Bedford subcatchment to the Wilge River (High).</td><td rowspan="9">12.1. Water volume released from Bedford subcatchment to resemble pre-reservoir in stream volumes.</td><td>12.1.1. Adopt water release regime to resemble run-off pre-reservoir. Volumes to be release from Bedford (upper) reservoir as follow:</td></tr>
<tr><td>
<table>
<tr><th>Month</th><th>Normal Release (10^6m^3)</th><th>Drought Release (11 % of Normal) (10^6m^3)</th></tr>
<tr><td>October</td><td>0.14</td><td>0.02</td></tr>
<tr><td>November</td><td>0.22</td><td>0.02</td></tr>
<tr><td>December</td><td>0.21</td><td>0.02</td></tr>
<tr><td>January</td><td>0.30</td><td>0.03</td></tr>
<tr><td>February</td><td>0.27</td><td>0.03</td></tr>
<tr><td>March</td><td>0.21</td><td>0.02</td></tr>
</table>
</td></tr>
</table>

Environmental Impact Significance	Objective	Target		
	12.2. Water release regime to resemble flow conditions pre-reservoir.	April	0.08	0.01
		May	0.03	0.00
		June	0.01	0.00
		July	0.01	0.00
		August	0.02	0.00
		September	0.07	0.01
		Performance Criteria • Monitor release from reservoir.		
		• Volumes to comply to targets.		
		12.2.1. Waste released from the Bedford (upper) reservoir to be a continuous flow. Total volume for month to comply to volumes stipulated above.		
		12.2.2. Point of release to resemble natural flow that existed before the construction of the reservoir.		
		Performance Criteria • Wetland downstream from reservoir remain in condition similar to that before the construction of the reservoir (Bedford reservoir).		

Environmental Impact Significance	Objective	Target
13. Soils highly erodable due to spores vegetation cover (Medium).	13.1. Disturbed and exposed surfaces to be rehabilitated.	14.1.1. Soils disturbed and/or exposed to be rehabilitated by shopping and revegetation within the same growth season of disturbance or exposure.
	13.2. Areas of poor vegetation cover to be revegetated.	14.2.1. Areas with poor surface cover to be revegetated with grass mixture similar to naturally occurring grass. (Note: list of natural occurring grass given in specialist botanical report – Volume II of EIR).
		Performance Criteria • Disturbed/exposed soils revegetated upon completion of shopping.
		• Grass mixture used for rehabilitation consists of natural occurring grass.
		• Rehabilitation areas support growth of grass.
14. Infestation of site by allien vegetation species (Medium)	14.1. Allien species to be eradicated from reservoir sites.	14.1.1. Assemble, train and equip workforce to be used for the removal of allien species from proposed sites.
		Performance Criteria • Workforce dedicated to allien species control in place.
		• Workforce trained in recognition of allien species, use of chemicals and equipment.
		• Removal of allien species from water catchment areas.

Environmental Impact Significance	Objective	Target
15. Effect on Afromontaine forest between two reservoirs (Medium).	15.1. Afromontaine forest not be disturbed.	15.1.1. Design and construction methodology avoid disturbance of afromontaine biome as defined in specialist botany report – Volume II EIR.
		Performance Criteria • Afromontaine forest is not disturbed at all.
16. Loss of wetland in upper reservoir basin, and below basin (High).	16.1. Maintain wetland below reservoir wall.	16.1.1. Impact on wetland below reservoir wall to be limited as much as is reasonably practicable. This to be achieved by maintenance of water release regime and technique as described in point 12.
17. Affect on amphibian and invertebrate species due to construction of the upper reservoir (Medium).	17.1. Impact on amphibian and invertebrate species to be limited.	17.1.1. Water release regime as per point 12 to be implemented.
		17.1.2. Monitoring of populations and specie diversity of amphibian and invertebrate species.
		Performance Criteria • Amphibian and invertebrate species in wetlands below wall of Bedford (upper) reservoir not impacted upon, both in terms of population number and specie diversity.
18. Effect of fish species that occur in the area of the upper reservoir (High).	18.1. Collect and preserve species in the (upper) Bedford reservoir area.	18.1.1. Collect specimens of fish in the river in the Bedford catchment before construction starts
		18.1.2. Describe fish and classify by species. Preserve any unique or species with a conservation value.

Environmental Impact Significance	Objective	Target/Performance Indicators
		Performance Criteria • Specimens of fish in Bedford catchment collected.
		• Specimens described.
		NOTE: During the EIA no fish species of with high conservation status were identified.
19. Change in the water quality of the upper reservoir due to mixing with water from the lower reservoir (Medium).	19.1. Maintain water quality to comply to South African Water Quality Guidelines for Agriculture.	19.1.1. Design the methodology to prime the system to ensure the least volume of water to be pumped from the Braamhoek (lower) catchment to the Bedford (upper) catchment.
		19.1.2. Monitor the quality of the water released from the Bedford reservoir to the Wilge River.
		Performance Criteria • Quality of water released from the Bedford reservoir to comply to the following standards:
		Nitrate: 0-100mg/*lN*
		Chloride: 0-1500mg/*l*N
		Alkalinity: 20-175 mg/*l*N Ca CO_3
		pH: 6-9
		TDS: 25-80 mg/*l*N
		Sodium: 0-2000mg/*l*N
		Magnesium: 0-500 mg/*l*N
		Calcium: 0-1000mg/*l*N
		Hardness: 20-175mg/*l*N Ca CO_3
20. Impact of the construction of the upper reservoir on Avifauna in area (Medium).	20.1. Limit the impact of construction on Avifauna.	20.1.1. To limit the disturbance of habitat, both grassland and wetland to the absolute minimum.

Environmental Impact Significance	Objective	Target/Performance Indicators
21. Stabilisation of water flow from reservoirs may cause a change in agriculture production along the river, this may lead to environmental degradation (High).	21.1. Not to cause stabilisation of water flow in the rivers downstream from the reservoirs.	21.1.1. Water release regime to be followed.
22. Instability in community during construction and shortly thereafter (Medium).		
23. Impact of the building of the reservoirs on the Braamhoek and Bedford farm units (High).	23.1. To compensate farmers for loss of farm units.	
24. Poor road current conditions would not support scheme (High).	24.1. Upgrade roads to support the requirements of the proposed scheme.	
25. Impact of earthworks (Medium).	25.1. Prevent earthworks to cause an aesthetic and/or erosion impact.	25.1.1. Implement a rehabilitation program for all exposed and disturbed soils.
		Performance Criteria • Rehabilitation to comply to requirements stated in Annexure A of the Environmental Management Plan.
26. Impact of borrow pits (Medium).	26.1. Prevent borrow pits from causing an aesthetic and/or erosion impact.	26.1.1. Implement a rehabilitation program for all exposed and disturbed soils.
		Performance Criteria • Rehabilitation to comply to requirements stated in Annexure A of the Environmental Management Plan.
27. Aesthetic impact of disposal of waste rock (Medium).	27.1. Waste rock disposal to be done in such a manner as to reduce aesthetic impact.	27.1.1. Dispose waste rock in the reservoir basin as far as is reasonably possible.
		27.1.2. Exposed waste disposal sites to be covered with topsoil and rehabilitated.

Environmental Impact Significance	Objective	Target/Performance Indicators
28. Impact of construction related waste (High).	28.1. Limit impact of construction waste.	28.1.1. Construction waste that would not lead to pollution i.e. cement, sand, concrete, waste bricks, etc. to be disposed and compacted in reservoir basin.
		28.1.2. Construction waste that could lead to pollution i.e. fuel, lubricants, solvents, metal, paint, etc. to be stored temporary in ships and disposed off site at registered dumping sites.
		28.1.3. Vehicle/equipment service and refuel areas to be bunded and supplied with hard surface to prevent soil pollution.
		28.1.4. Ground water in area surrounding french drains to be monitored for possible pollution from drains.
29. Noise nuisance caused by construction activities (Medium).	29.1. Limit noise nuisance caused by construction.	29.1.1. Monitor noise in environment during construction.
		Performance Criteria • Ambient sound at receptors (residential homes of farms) not to increase by more than &dB(A) due to construction activities. Measurements to be done by means of integrating impulse sound level meters in compliance with Regulations R2544 made in terms of the Environmental Conservation Act (No 73 of 1989).
30. Impact of domestic waste (Medium).	30.1. Prevent domestic waste disposal on site to cause environmental impact.	30.1.1. No disposal of domestic waste to take place on site. Disposal to be done at Municipal dumpsite of Harrismith.

Environmental Impact Significance	Objective	Target/Performance Indicators
31. Light pollution during construction and operational phase (High).	31.1. Reduce impact of illumination on site on the aesthetics of the environment.	31.1.1. Light beams directed to the horizon or up into the sky to be prevented during construction and operation.
		31.1.2. Only critical aspects of scheme to be illuminated to reduce the light hollow emitted from the scheme.